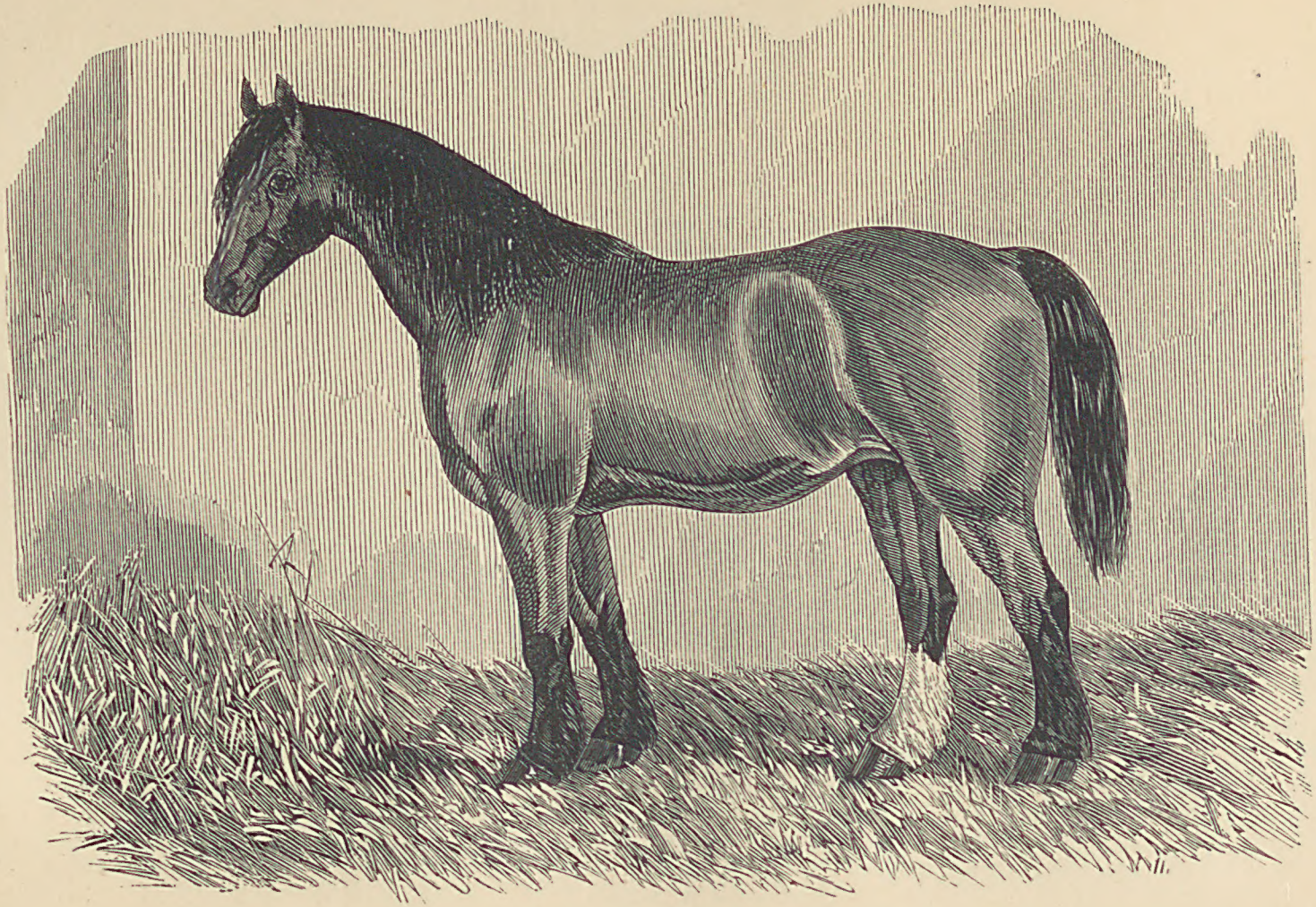
DEPARTMENT OF AGRICULTURE
INDUSTRIÆ NIHIL IMPOSSIBILE
VICTORIA

REPORT

OF THE

SECRETARY FOR AGRICULTURE,

ETC., ETC.



CLYDESDALE MARE, "GLASGOW MAGGIE."

Property of Mr. W. McCulloch, *La Rose, Victoria.*

Department of Lands and Agriculture, Victoria.

SECOND ANNUAL REPORT

OF THE

SECRETARY FOR AGRICULTURE.

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REPORT.

TO THE HONORABLE JAMES JOSEPH CASEY, M.P., MINISTER OF LANDS AND AGRICULTURE, ETC., ETC., ETC.

Department of Agriculture,
Melbourne, 1st June 1874.

SIR,

I do myself the honor to submit for your consideration the Second Annual Report of the proceedings of this department. An experience of the working of the Department of Agriculture, extending a little over eighteen months, in other words, over a period since its establishment in November 1872, has proved to my satisfaction that, if liberally endowed and skilfully directed, its benefits to the community will be practically illimitable. The number of persons who seek the advice of the department on matters relating to cultivation, in the most comprehensive sense of that word, increases steadily from month to month; and the appreciation by the public of the benefits which it already confers, and the good which it is destined hereafter to perform, is made daily more apparent. The manner in which the First Annual Report was received, and the high terms in which it was referred to, not only in this, but likewise in the home and foreign countries, has proved most gratifying to all who took part in its production, and has given encouragement to the exercise of increased effort on this occasion. The spirit with which a number of persons have come forward, in response to my invitation, and given gratuitously, for the public good, information which they have gained on special subjects after years of persevering study, cannot but prove gratifying to every member of this community. These persons are deserving of all praise for the patriotic spirit which they have displayed; and I desire here publicly to

acknowledge my gratitude to all those persons, many of them my private friends, who have aided me in the preparation of this Report, by contributing papers at once highly interesting and instructive.

A copy of the last Annual Report of the Department of Agriculture has been presented to each Agricultural and Horticultural Society and to every Mechanics' Institute and Free Public Library in Victoria; likewise to a few leading agriculturists in various parts of this colony. Copies have also been transmitted, in exchange, to the Departments of Agriculture and leading Agricultural Societies in foreign countries; and some have been presented to prominent public men in the neighboring colonies who are in communication with this department, and to whom the department is under an obligation for information supplied from time to time—for example, the Chief Inspectors of Stock in New South Wales and Queensland, the Secretary of the Chamber of Manufactures in South Australia, and others. But withal, the distribution of that Report, in my opinion, has not been sufficiently general; and I am disposed to think that, while much good would be effected by its free and gratuitous distribution in the country districts, still that it would be wise to exact a small sum for each copy—say 6d. or 1s.; believing that that which is purchased is always more valued than that which is obtained as a free gift. The prices now charged, viz., 3s. for an unbound copy, and 5s. for a copy bound in cloth, in my opinion, are exorbitant. These prices will, I fear, tend to limit the circulation, and thus prevent that wide diffusion of the information which these reports contain, which, in the interests of agriculture, should be made as extensive as possible.

Hop-culture is making rapid strides in Victoria. The large returns which are reported to have been obtained from comparatively young hop-grounds, have probably had much to do with the increased attention that has been given to the cultivation of this crop. The soil and climate of a considerable area of our territory is pre-eminently adapted to the development of the hop-plant. It delights to grow in deep rich loams, such as exist on river flats and low lands, formed by the deposition of decomposed or disintegrated

rocks and vegetable debris in Gippsland and many other districts of Victoria. It will also attain perfection in the friable, red, volcanic soils frequently met with in our mountain ranges. The yield obtained from young hop-grounds in this country, in some instances, is quite astounding, as much as 15 cwt. and upwards per acre having been gathered from plantations when only two years old. These extraordinary returns, however, cannot be expected to continue, unless much attention be paid to the maintenance of the fertility of the soil. The hop is a most exhaustive crop, and it is well known to farmers that it requires more manure for its development than any other plant which they cultivate. The American hop-growers are quite aware of this, and as soon as land under hops shows signs of exhaustion, they root out the crop and form a new plantation. The average duration of hop-grounds in the United States does not exceed nine years, even in the limestone district. It is probable that our hop-grounds will fail in a precisely similar way, unless growers take the necessary precautions to maintain the fertility of their soil. Considering the growing importance of this industry, and the desirability of obtaining the experience of those already engaged in it, I deemed it desirable to issue circulars to the principal hop-growers throughout the country. A digest of the information received, and full particulars regarding the cultivation of the hop-plant in this colony, will be found at page 178.

Flax has been experimentally grown in various districts of the colony from seed supplied by this department, but—as was anticipated in my Report of 1873, at page 4—the results have been far from satisfactory. Failure has been attributed generally to the excessive dryness of the spring and early summer months, and the frequent recurrence of hot wind. Climatic influences, however, are not the only obstacles to the profitable cultivation of flax in Victoria. The scarcity of labor, and the want of implements to supersede hand work in the operations of harvesting and after-treatment, add materially to the cost of production, and, unless the crop be good, leave but a small, if any, margin for profit. The removal of these last-named obstacles is one of the matters which have occupied the attention of this department during the past year; and it has

decided to offer, in conjunction with the Adelaide Chamber of Manufactures and the Royal Agricultural Society of South Australia, premiums for the invention and manufacture of flax-harvesting machinery. The conditions of competition for the projected inter-colonial contest are given at page 298, some further particulars regarding flax and flax machinery at page 293, and the report and awards of the judges appointed to examine the samples of flax forwarded for competition, in accordance with regulations approved by His Excellency the Governor in Council, at page 295.

The past season has been very favorable to the growth of the vine. The crop of grapes has been good generally throughout the entire colony, and in many localities the yield has more than doubled that of any previous year. The vintage of 1874, it is confidently stated, will be the best, as regards both the quantity and quality of the wine made, that has yet been known in Victoria; and now that our vineyards are gaining age, the produce equals, if it does not excel, the growths of the celebrated wine countries of the old world, as the awards of the Vienna jurors testify. The importance of the vine as a plant for extensive cultivation in Victoria, and the suitableness of her soil and climate for its development to the highest degree of perfection, will, with the increasing demand for Australian wines in Europe, doubtless result in a considerable extension of the area under vines within a comparatively short period.

During the past year the vineyards of the colony have been comparatively free from disease. The oïdium Tuckeri, of which so much was heard two years since, has been less disastrous in its results, and only in exceptional instances have complaints of its ravages been made; and even in these the injury done has been confined to a few varieties of grape, or to small plots in large vineyards and vine-growing districts. The black-spot, too, has been less virulent, scarcely any complaints of injury from this source having been recorded. The severe frosts which were experienced during the spring, and just after the vine had put forth its tender fruit-bearing shoots, created much havoc in certain districts, and

caused far greater damage during the past year than did all the diseases to which the vine is subject.

For the purpose of obtaining a correct knowledge of the extent and importance of the vineyard interest of Victoria, and certain particulars regarding the experience of vignerons in the cultivation and management of the vine in the different districts, this department issued a circular in December 1873 to every vinegrower whose name and address could be ascertained, soliciting such information. The replies to this circular, it is to be regretted, are neither sufficiently numerous nor conclusive to warrant the expression of an opinion as to the extent to which this important and growing industry has attained. However, some of the replies which have been received contain much information of public importance; and, in order to give the same as early and as wide a circulation as possible, extracts from these replies are published at page 302. It is intended to again solicit information from persons who have not replied to the former circular, that this department may be in a position, at a future date, to supply information concerning the present dimensions and probable extension of the vinegrowing industry of Victoria—an industry for which both the soil and climate of this country are admirably adapted.

The grasses indigenous to Australia form the subject of an interesting and valuable paper from the pen of Mr. W. H. Bacchus, who has made the native grasses of these colonies the chief study of his leisure moments, during a period of more than thirty-five years. Mr. Bacchus has expressed his intention to lodge with this department, as far as practicable, a specimen of each grass described in his paper; and as the subject is one of great importance, and little of a practical character has been done in this direction hitherto, I would suggest that a portion of the Botanical Garden should be set apart for the systematic culture of our indigenous grasses, and of those exotic species which have proved, or are likely to prove, valuable as fodder or pasture plants in Victoria. By the adoption of this course, the public would be able to examine in nature each grass described by Mr. Bacchus, and to compare the living plant with the drawing of it which is given in this volume. Mr. Bacchus'

paper has been extensively illustrated with lithographs executed from original drawings made by Misses A. E. Bacchus and G. M. B. Gilbert. The manner in which these illustrations have been executed will testify to the ability of the lithographer, Mr. S. B. Bonney.

Since the above was written, I have been informed by Mr. Guilfoyle, Curator of the Botanical Garden, that it is his intention to set apart a portion of that reserve for the display of the indigenous grasses, and other useful fodder and pasture plants.

An interesting and instructive paper on "Diseases among Stock" has been contributed by Mr. W. Thomson, F.R.C.S. The large number of inquiries that have been received by this department, from time to time, regarding the various diseases to which stock are liable in Victoria, and the cures and preventions for such diseases, pointed to the necessity for issuing a circular to every stock-owner in Victoria, whose name and address could be ascertained, requesting information as to the extent of disease among his stock, and the nature and fatality of the same. The replies received have been digested, and the information contained in them, together with the previously existing knowledge and experience of the amount of disease among Victorian flocks and herds, many of which diseases permit of simple treatment and easy cure, demonstrate the need of a more wide-spread knowledge of veterinary art among the stock-owners of this colony.

The orange, and its adaptability for cultivation in Victoria, form the subject of an interesting paper, which has been kindly contributed by Mr. Josiah Mitchell. Oranges are largely imported into this country from New South Wales, where they attain to great perfection, principally in the neighborhood of Parramatta. There are many places in Victoria where the orange will grow equally as well as in Sydney; for example, in the neighborhood of the Gardiner's Creek, the land which skirts the mountain ranges to the north-east of the township of Seymour, and many localities which lie between these ranges and the River Murray; and seeing that the orange is one of the most remunerative of all crops, it is surprising that its cultivation has received so little attention in this colony. It is with the hope of giving an impetus to the production

of this delicious and profitable fruit, and eventually supplying our own wants, that an account of the orange and how to cultivate it has been given. Mr. Mitchell's paper contains a brief but comprehensive description of the management of this fruit-bearing tree, and intending growers will find in it much valuable and reliable information.

The apple has claim to be considered the most important of fruit-bearing trees. No tree furnishes us with a fruit which is applicable to so many purposes, or which is obtainable in perfection during so many seasons of the year. In nearly every, if not in every month, some variety can be procured, and at some seasons the kinds obtainable are numbered by scores. The cultivated varieties of the apple are very numerous. Many hundreds are described by Downing in his work on the "*Fruits and Fruit-trees of America,*" and upwards of 1000 varieties are contained in the garden of the Horticultural Society of London. Many of these are of course inferior, and few alike adaptable to different countries, or even different localities of the same country, and it is only by comparison in an experimental garden that the value of the different varieties for a given climate can be ascertained. Mr. J. C. Cole has cultivated the apple experimentally for many years in his garden at Richmond, and he has kindly given me the benefit of his experience with twenty varieties which, in his opinion, are among the best for general cultivation in the neighborhood of Melbourne. Mr. Cole's views are embodied in a paper on the apple, which is given at page 203.

Entomology in its relation to agriculture is a study of far greater significance than at first sight would appear. When we reflect upon the losses sustained year by year from the ravages of locusts, of caterpillars, of aphides, of that terrible scourge called Phylloxera vastatrix—which happily, so far as is known, has not been brought to these shores—and from the devastation of the several species of Coleoptera, the importance of entomology becomes at once apparent. For the purpose of illustrating the damage which is done to some of the more valuable of our timber trees by wood-boring beetles, I have obtained from Mr. Charles French, who has devoted

considerable attention to this branch of entomology, a description of some of the more destructive members of this family of insects ; and seeing the necessity for a systematic inquiry into this subject, I would recommend that Mr. French, who is employed in the Botanical Garden, be engaged, during overtime, to examine and report on any destructive and other insects which from time to time may be forwarded to this department, and to advise generally on entomology, and that he receive an honorarium for the services thereby rendered.

The meteorology of Victoria forms the subject of an interesting and valuable contribution from the pen of the Government Astronomer. Mr. Ellery's paper traverses the whole of the meteorological observations of agricultural importance made and recorded in Victoria from the earliest times to the commencement of the current year, and will be invaluable for reference to agriculturists throughout Victoria. The influence which climatic agencies exert, for good or evil, on the crops of the farmer, is every day more clearly demonstrated and more freely acknowledged, and it is intended from year to year to give a digest of the meteorological observations, which influence production, made and recorded at Melbourne and the several stations in the country districts.

The Phylloxera vastatrix is reported to be raging with unremitting virulence in the vineyards of France and Germany, and the price of clarets and other light wines is said to have advanced 100 per cent. in consequence. This increase in the price of the European vintages opens the way for the introduction and permanent establishment of Australian wines upon the London market; and the utmost vigilance should therefore be exercised to keep this dreaded scourge from encroachment upon our shores. It is rumored that grape vines and grape vine cuttings have been imported only recently into Victoria from Europe, the Grape Vine Diseases Prevention Statute notwithstanding. I would suggest that all plants brought to this country, from whatever part of the world, should be examined in future by an expert before permission to land them be granted.

Though it was generally thought that locusts would appear in

great numbers during the past season, and materially impair the carrying capabilities of some districts, but few of these wasteful and destructive pests have been seen. One gentleman, who writes from the Wimmera district, states that he attributes this non-appearance of locusts to the fact that the vitality of the eggs were destroyed by the parent insect having to give sustenance to the larvæ of the Ichneumon fly, which, it will be remembered, has been observed to attack the perfect insect and deposits her eggs under the thorax of her victim. If this be the case, and there are good grounds for believing it is, it serves to demonstrate how one species of insect life destroys another, and how important it is that these matters, which come within the province of the entomologist, should be more generally known, in order that insects which are beneficial to the cultivator, inasmuch as they tend to avert calamities such as a visitation of locusts, may receive such protection from injury as their importance demands.

The past summer was distinguished by the appearance, in considerable numbers, of a bird known to colonists by the names "white-eye" and "summer bird"—the Artamus superciliosus of Gould. This species, which resembles in form and flight the swallow, is of a slate color on the back and rich chestnut on the breast. It is a native of this continent, and, according to Gould, seldom leaves the interior of the country. However, it does at times migrate southward, for it has been observed on several occasions in Victoria. Mr. Thos. Davey, who resides in the Wimmera district, has informed me that it was seen in large flocks during the summers of 1870–1 and 1871–2 in the country to the north of Stawell, and that it was observed to follow the locusts, which at that time were present in great numbers, and devour large quantities of this destructive insect. Last summer, flocks were seen in the neighborhood of Melbourne, where they were noticed to do much good by devouring the caterpillars which had attacked the vine and other crops. The summer bird is said by some persons to be the forerunner of dry seasons. It is strictly insectivorous, and should in consequence be scrupulously preserved. Some further remarks and a woodcut of the bird will be found at page 285.

Parasitic diseases in sheep appear to be ever on the increase. Complaints are frequently heard of country formerly unknown to be fluky becoming affected, and unless an effectual and practicable remedy should be discovered shortly, this disease threatens to overspread the entire country. Various reasons are assigned for its extension. Some attribute it to the exceptional humidity of the spring and autumn months of the last few seasons; others to the fencing of runs; and others to overstocking, and the gradual disappearance of saline and bitter herbs from our native pastures, which naturally follows upon such a system. There can be no doubt but that each of these contributes its part towards the spread of fluke—the last-named in the most marked degree; and it is probable that flock-masters will find it incumbent upon them to devote attention to the introduction into their grass lands of those saline and bitter herbs which constitute so large a portion of Australian virgin pastures, if the country is to be freed from this disease. Fluke, however, is not the only parasitic disorder which has been brought prominently under notice during the past year. A species of thread worm (Filaria) is reported to have caused great mortality among sheep in the Werribee district. The subject was brought before a meeting of the Microscopical Society by Dr. Youl, who stated that he attached great importance to the consideration of this disease, as it had already killed thousands of valuable sheep. Animals which become affected rapidly fall off in condition and die, if not attended to and treated with the following simple remedy, viz. :—

Nitre	...	...	...	12 ounces
Sulphur	...	...	...	50 „
Water	...	...	...	100 „

The mixture to be well stirred, and given in one-ounce doses four times at ten days intervals, the sheep being allowed access at the same time to a mixture of salt with 10 per cent. of sulphate of iron. This remedy has proved marvellous in its results, every sheep which has been treated having recovered. Mr. Alexander Bruce, Chief Inspector of Stock in New South Wales, informs me that this disease is well known in that colony, and that he has no doubt

the nitre and sulphur cure is an efficacious one. Further particulars of parasitic diseases are given at page 279.

The National Exhibition of Live Stock and Implements, held under the auspices of this department, and in connexion with the Smeaton, Spring Hill, and Bullarook Agricultural Society, proved a marked success; indeed it was pronounced by many the best agricultural show ever held in Victoria. As was anticipated, the implement classes were not well filled, though the number of entries, particularly in the sections for heavy machinery, surpassed expectations. The classes for all kinds of live stock were well represented. The display of horse-stock, particularly in the brood mare sections, was pronounced the best which the colony has seen. The entries of all kinds in the horse class reached the high number of 251, upwards of one-half of which comprised draught animals. The cattle sections were well filled, the exhibits including animals from some of the principal herds of the colony. Sheep, especially long-wools, were shown in great number; and in this particular the 1873 exhibition of the Smeaton society eclipsed any spring show previously held under its auspices. This increase in the number of sheep shown testifies to the change which is taking place in the agriculture of the district, and marks the transition from an exhaustive and wasteful course of cropping to a rational system of husbandry, in one of the most extensive and naturally productive farming districts of Victoria. The Smeaton Agricultural Society, unlike its sister institutions, is not content to hold an annual show of live stock and implements, but likewise offers prizes for the best managed farms of above and below 100 acres in extent, situated within the district which it represents. The prize farm system has proved most beneficial in promoting agricultural improvement in other countries, and, judging from results in the case of the Smeaton society, is likely to prove so in this colony.

The same change in the system of cultivation which is noticeable in the Smeaton district is to be observed in all the older centres of agriculture, and every year the breeding and rearing of long-woolled sheep enter more largely into the system of management adopted; and this improved system will administer in a marked degree towards the

welfare of Victorian agriculture. Fuller particulars of the shows held by the agricultural societies in 1873 are published at page 223.

Steps have been taken towards the establishment of Farmers' Clubs in connexion with the leading agricultural societies of Victoria. The good which such institutions exercise, when judiciously directed, for the advancement of improvement in the practices of farm management, and for the promotion of the agricultural interest generally, is brought yearly more prominently under notice by the proceedings of farmers' clubs in foreign countries. The annual exhibition of farm stock and farm produce, and the struggle for supremacy on the part of the exhibitors, contribute largely towards the improvement of the breeds of cattle and the promotion of skilful husbandry. But the working of agricultural societies is not sufficient. It is desirable, indeed imperative, that farmers should meet together at appointed times and places, to discuss the several matters which regulate and influence their avocation; to discuss the cultivation of the different crops grown, the breeding and management of stock, the treatment and prevention of diseases among cattle, the growth of new and important plants, the establishment of new rural industries, the subjects which oppress the agricultural interest, and likewise those which are essential to its advancement. Discussions of this kind come within the province of a farmers' club, and if agriculturists will receive their just rights, they must learn to unite, as other sections of the community unite, and advance their claims. Farmers' clubs tend also in other directions to good. They render less isolated the occupation of the farmer, and by placing standard works on agriculture and its allied sciences, the leading agricultural journals of foreign countries, and the transactions of foreign clubs, within his grasp, tend to elevate him intellectually, or at least to keep him informed regarding the improvements made in the practice of agriculture in every quarter of the globe. The establishment of farmers' clubs in connexion with the agricultural societies is a subject worthy of attention—one which, in my opinion, is equally, if not more, entitled to consideration from the Government than the subsidising of agricultural societies for the holding of annual shows.

The subject of agricultural education is one of growing importance. At the present time, any person who travels from the sea to the Murray, from the boundary of New South Wales to the confines of South Australia, will witness, with few exceptions, one uniform system of reckless land-spoliation—a system which, unless checked, is calculated to bring inestimable misery upon this country, and that at no distant date. The exhaustive system of cropping pursued in Victoria is due in great measure—and this view of the case cannot, I think, be called in question—to the want of special knowledge on the part of the cultivators of our soil—to the want of a wider knowledge of the principles which regulate agricultural practice. This knowledge it is that needs to be supplied. Just as the disastrous results brought about by the uninterrupted cultivation of one plant on the same land, and its inevitable exhaustion in consequence, were made evident in Ireland by the appearance of the potato famine in 1846, and led to the establishment of a national system of agricultural education in that country, by the instrumentality of which a knowledge of the rotation of crops has been introduced into districts where rotation cropping had been previously unknown, and where the potato and the oat were the only crops formerly cultivated ; and as the exhaustion of the soil in America, and the estimate made twenty-five years ago, that to restore the land then under cultivation in the United States to its original fertility would cost a thousand millions of dollars, about £200,000,000,* led to the foundation of schools of agriculture throughout the length and breadth of that land, so is it probable that like circumstances will lead to precisely similar results in Victoria. And it is high time, now that the church, the law, and the sword have their colleges supported by the State, that the plough should have hers ; for I contend it is as much a matter of national policy to teach the people how to feed men scientifically as to kill them, and that a knowledge of how and upon what we subsist is as essential to the moral well-being of a nation as is a knowledge of divinity and law. The instruction of the rural classes

* United States Department of Agriculture Report, 1868, p. 127.

in the principles which govern the practice of agriculture is a subject which I would commend to your serious consideration.

With regard to agricultural settlement, its progress is most marked upon the deep tertiary deposits, which extend, for the most part, northward from the Dividing Range to the River Murray. The capabilities of this vast territory have not as yet been fully tested. The lands situated within its boundaries have been devoted, until quite recently, to pastoral purposes; and, since they have been occupied as farms, have been applied principally to the production of wheat. No attempt appears to have been made hitherto, towards the development of crops adapted for cultivation in regions which possess a sub-tropical climate and fertile soil, such as does the one under consideration—crops equally conducive to the welfare of the people and to the development of the country. It is more than probable that, within a comparatively short period, we shall witness in these northern districts many of the more important and easily grown plants of southern Europe, and of parts of India and other countries, which enjoy a similarly favorable climate—for example, the indigo, castor oil bean, opium poppy, almond, camphor, sweet chestnut, cork oak, fig, prune, orange, shaddock, olive, and many other products—cultivated side by side with the cereals, grasses, and fruits of more temperate zones.

Agricultural settlement is likewise taking place to some, though by no means so considerable extent in Gippsland. The soil and climate of this portion of the country are pre-eminently adapted to the development of root crops, and the breeding of long-woolled sheep—in short, to a system of mixed husbandry, such as is pursued in Britain. Like other districts, however, Gippsland has its drawbacks. The majority of the land, which is open for selection, is densely timbered, both with large trees and undergrowth, and consequently expensive to clear—much more expensive, it is thought, than is generally represented. The land too, for the most part, is exceedingly patchy; particularly is this the case in the neighborhood of Brandy Creek, the land in which locality has attracted much attention of late. In some places it is of a deep chocolate color and of the most fertile description, while in others it consists of a

pale, tenacious, soapy clay—a soil much more difficult to work, and much less productive, than at first sight would appear. The chief matter to be contended with is the difficulty and expense of clearing; but, when cleared and brought under cultivation, there can be no question as to the adaptability of Gippsland for a system of mixed husbandry.

In accordance with an application made by the combined agricultural societies, a sum of £530 was placed upon the Estimates of 1873-4 for the invention and manufacture of a mechanical reaper and binder, provided that a sum equal to that amount be contributed by the agricultural societies. Some action was taken subsequently by the Ballarat Agricultural Society, without this department being consulted, or even acquainted, with the steps which it was proposed to take, and a meeting of delegates (three in number) was held at Ballarat on the 23rd September 1873, at which a code of conditions was agreed upon. A copy of these conditions was forwarded to each of the contributing societies for approval, together with a request that the matter might receive the society's immediate attention, and that its approval might be communicated to the secretary of the Ballarat Pastoral and Agricultural Society on or before a given date. No copy, however, was submitted for the information or consideration of this department; and, as the money placed on the Estimates could not be made available excepting under conditions in accordance with the terms upon which it had been voted—viz., "for the invention and manufacture of a mechanical reaper and binder"—I wrote to the president of the Ballarat society, requesting to be supplied with a copy of the above-mentioned conditions. To my surprise I found that they were not in conformity with the terms of the vote, and it devolved on me to bring this circumstance under the notice of the Ballarat society, through its president. Some time afterwards—viz., on the 23rd October 1873, when replies had been received from the contributing societies, and some of them had expressed their willingness to adopt the conditions submitted without reservation, but others not so—the president of the Ballarat society waited upon you at the Houses of Parliament, and requested your approval of the same, notwithstanding the fact that

the conditions were not in accordance with the terms upon which the money had been granted. Some correspondence ensued, but no definite understanding was arrived at, and, consequently, no trials were held. That the matter may not again be driven off until the harvest is near at hand, I propose to address a circular to the contributing societies, bringing the circumstances under their notice, and requesting them to have the goodness to acquaint this department with their views on the subject, and the steps which should be taken to bring it to a successful issue, should it be their intention still to contribute.

During the past year a new branch has been added to this department—one which, under liberal management and skilful direction, will contribute largely to the welfare of this community. I allude to the chemical branch, which was established, and placed under the direction of Mr. W. E. Ivey, in September 1873. For several weeks, however, after his appointment, Mr. Ivey was engaged solely in travelling and reporting upon the forests of the colony, and in collecting soils for analysis, and consequently the real work of the chemical branch was deferred for a time; indeed, what with the duties above referred to, the alteration of the laboratory under Mr. Ivey's superintendence, the preparation of re-agents, &c., the analytical work did not commence until after the new year. A very satisfactory amount of work has been executed by the chemical branch since its establishment—a quantity indeed far beyond my expectations. Mechanical and chemical analyses have been completed of soils from the more important forest lands and some of the principal agricultural districts of the colony, and several analyses of soil have been made for persons in different parts of the colony, who have sought the assistance and advice of the department in this direction; a considerable number, moreover, still remain on hand to be done. It is anticipated that when the privileges offered by this branch become better known, more work will be required of it than it will be able to perform, at any rate with its present staff. In addition to analyses of soils, a number of samples of manure have been obtained from the principal metropolitan manufacturers, and subjected to chemical investigation in the laboratory, with

varying results. The samples of bone-dust that have been examined have proved in every instance of the first quality; but the samples of superphosphate, without exception, have been found deficient in monocalcic or soluble phosphate, the principal constituent of a superphosphate. A good sample should contain from 20 to 24 per cent; and samples decrease in value as they contain a less percentage of this ingredient. The substance which forms the basis of superphosphates manufactured in Victoria is of the best description, but the high price of sulphuric acid seems to act as a barrier to its economical production. I have not had sufficient experience of Mr. Ivey to form a definite opinion of his ability; but, judging from the work that he has done since his accession to office, I am disposed to think that he is well qualified to fill the position of chemist to this department, and I am supported in this opinion by Dr. Voelcker, F.R.S., Chemist to the Royal Agricultural Society of England, whose pupil Mr. Ivey was, and who has spoken to me in the highest terms of praise concerning him. Dr. Voelcker, in a letter to me, speaks of Mr. Ivey as follows:—"Mr. Ivey, during his pupilage, paid much attention to chemistry, and spent much time in my private laboratory, and did exceedingly well. His knowledge of chemistry and skill in practical chemical work was much above the standard reached by students. He is a very good hand at analysis, and I would not have hesitated when he left me to have given him an appointment in my laboratory as an assistant had he sought such an office." Mr. Ivey's report is published at page 31.

The vote in aid of the agricultural societies has been distributed in conformity with the regulations approved by the Governor in Council, viz., upon the sums paid away in prizes between 1st January 1873 and the 1st January 1874. An arrangement has been made by which all the societies in future will date their financial years from the 1st January, and by which all claims upon the vote must be made for moneys expended between the 1st January of one year and the 1st January of the year next following; and no society which may be established hereafter will be permitted to deviate from this rule. This change, while it will obviate confusion in future, has necessarily caused some irregularity in the payment in full of the

claims made by some of the societies on moneys paid away prior to the 1st January 1874, and upon which the claims of such societies were unsatisfied. It was customary in former years for each society to make up its return to the date of its last financial year, whensoever that might happen to fall. The consequence was that the returns sent in to this department were dated in all months of the year, which caused much confusion, and, not unfrequently, much delay in the distribution of the vote. The result of this change of dates, however, has been the extension of the period over which some of the societies are entitled to make claim. For example, the Ballarat Agricultural Society, in the ordinary course, would only have made claim on moneys paid away in prizes during its financial year ended May 1873. Under the new rule, however, the claim made this year by that body extends over a period of one year and eight months. It has received payment out of this year's vote on the moneys returned as paid away in prizes between the 1st January 1873 and the 1st January 1874, and is still entitled to receive one-half of the sum so paid away between the date of its financial year 1872 and the 1st January 1873. The same holds good in the case of certain other societies — Bendigo, Kyneton, and Smeaton among the number. To meet the claims of these societies, a supplementary vote has been taken.

It is proposed to make certain alterations in the distribution of the vote in aid of the agricultural societies for the ensuing financial year. It has been usual in years gone by to pay to each society a sum equal to one-half of the amount paid away in prizes by such society during its last financial year, provided that such sum did not exceed the amount raised by private contributions, and that the total of the claims made was not in excess of the sum voted; the treasurer of each society being required to make a declaration as to the foregoing particulars. It is unsatisfactory to have to report that certain societies have included under the head "private contributions" moneys raised by entrance fees, admission to the show-yards, the sale of booth sites, and even the sale of dinner tickets. It is proposed in future to limit the items to be included under this head to the following, viz :—

1. Moneys raised by members' subscriptions.
2. Moneys obtained as private donations.

It is likewise contemplated to limit the claim on moneys expended in prizes to such as include sums paid away for legitimate agricultural exhibits. It is customary with the agricultural societies to offer prize-money for sporting dogs, lap-dogs, rabbits, ferrets, cats, guinea-pigs, hunters, fancy needlework, Berlin wool work, and such like, for the purpose of popularising the societies and attracting greater numbers to their shows. In my opinion, the prize-money for such exhibits should not be included in any claim made on the vote. It ought to be sufficient that the societies benefit by the entrance-fees, and the increased takings at the gates, which the admission of such exhibits to the show-yard effects. By the exclusion of prize-money paid for such exhibits from the claims of the societies, a portion of the vote would become available for the encouragement of farmers' clubs, a much more praiseworthy object.

It is also proposed to exclude from participation in the vote all societies that do not pay away annually in prizes a sum exceeding £100. It is held that the multiplication of small societies is conducive of injury rather than good, and that it is better to encourage a lesser and more influential number, with a view to their permanent establishment, and to the making of them hereafter the agents, so to speak, of this department in the districts which they represent, than to hamper their efforts by fostering smaller and rival kindred institutions.

It is proposed in the ensuing year to request the agricultural societies to furnish, through their respective secretaries, quarterly reports of the state of agriculture in the district represented by each such society; these reports to contain information regarding the condition of the crops, the diseases and mortality among cattle, the prospects of the harvest, &c. It is imperative that such reports should be published as received; but, to enable the work to be satisfactorily executed, it will be necessary to place increased facilities at the disposal of this department, for the collating and preparation of such reports for publication.

The vote in aid of the Horticultural Societies of Victoria has

likewise been distributed in conformity with the regulations approved by the Governor in Council. A schedule of the distribution of the vote is published at page 329.

Claim has been made, but not substantiated, on the vote for the encouragement of the manufacture of sugar from beet-root grown in Victoria. The regulations provide that the whole sum (£5000) will be paid to any person or company producing proof to the satisfaction of the Government that he or they have manufactured, locally from one manufactory, within twelve months on or before 30th June 1874, a quantity of not less than 500 tons of sugar from beet-roots grown in Victoria, and that a proportionate sum of such £5000 will be paid to any person or company for a quantity of not less than one hundred tons so manufactured. The claimants advance that they have manufactured 223 tons 12 cwt. 2 qrs. 8 lbs. within such period, which quantity is made up of items as follow, viz :—

	Tons	cwt.	qrs.	lbs.	
1.	45	17	0	12,	manufactured between 30th Sept. and 11th Dec. 1872.
2.	71	17	3	20,	„ „ 30th June 1873 and 30th June 1874.
3.	100	2	3	25,	utilised for spirit.
4.	5	14	2	7,	lost by waste.
	223	12	2	8	

It will be observed that 45 tons 17 cwt. 0 qrs. 12 lbs. were manufactured between the dates of the 30th September and 11th December 1872, and consequently could not be permitted to be included in any claim for sugar manufactured from beet-root within twelve months on or before 30th June 1874; 5 tons 14 cwt. 2 qrs. 7 lbs. are returned as lost by waste, and 100 tons 2 cwt. 3 qrs. 25 lbs. as utilised for spirit, thereby leaving a balance of only 71 tons 17 cwt. 3 qrs. 20 lbs., or less than 100 tons. It is certainly a most unusual course to first separate sugar from beet-roots *as sugar*, and then to distil the sugar so obtained into alcohol. The most marked differences in the utilisation of beet-root for the manufacture of sugar and the distillation of alcohol are the complexity and costliness of the operations in the former instance, and their simplicity and inexpensiveness in the latter. A beet-root

distillery is generally attached to a beet-root sugar manufactory, and acts as a safety valve against loss in years when the roots contain too low a percentage of saccharine—8 per cent. and under —to warrant their utilisation for the manufacture of sugar. There are three methods of distilling beet-roots for alcohol. They are admirably and concisely described by Dr. Voelcker, F.R.S., Chemist to the Royal Agricultural Society of England, as follows :*—

"1. The pulp is mixed with a small quantity of sulphuric acid, and then placed in suitable presses ; the expressed pulp is carted away, and constitutes a valuable food for cattle. The juice is run into the fermenting vats, of convenient capacity. A number of fermenting vats, generally made of wood, and filled with juice in a more or less advanced state of fermentation, are kept in a separate room, in which a proper and uniform temperature, highly conducive to a steady fomentation of the sugary liquid, is maintained. When all the sugar has been transformed into alcohol, and the fermentation been completed, which is seen by the liquid ceasing to give off bubbles of carbonic acid gas, and becoming quiet, the dilute alcoholic liquid or wash is pumped into the stills, and, by the simple process of distillation, the alcohol, more or less diluted with water, and contaminated with certain by-products of fermentation, is separated from the larger proportion of the water, which remains in the stills, and subsequently is allowed to run to waste as useless. By these simple operations impure spirit of a certain strength may be obtained by laborers of ordinary intelligence."

"2. The sliced beet-roots are subjected to the process of maceration, and displacement of the sugary juice by hot wash (Champonoi's method). It is essential to success that the slices are neither too thick nor too thin ; in the former case, the liquid employed in macerating the sliced beets, which is slightly acidulated with sulphuric acid, does not readily penetrate the cells containing the sugary juice, and a larger quantity of liquid has to be used for the extraction of the juice than is necessary if the slices are of the proper dimensions. In consequence of this excess of acidulated

* "*On Sugar-Beets and Beet-Root Distillation*" : *Journal of the Royal Agricultural Society of England*, 2nd series, vol. vii., part i., p. 75.

water, which has to be used in order to avoid loss of sugar, the juice obtained under these circumstances becomes too dilute to ferment subsequently with regularity. On the other hand, if the slices are too thin, their texture is broken up too much, and they are apt to form pulpy masses which can only be imperfectly extracted by the warm macerating liquid. In Champonoi's process of maceration, the use of presses is avoided, and the sugar contained in the beets passes by displacement into solution. The sugary liquid readily enters into fermentation without the addition of yeast. The alcohol contained in the fermented juice or wash is finally obtained by distillation in ordinary stills."

"3. According to Leplay's plan the beets are sliced, and the slices placed in vats and subjected to fermentation without undergoing any previous treatment. During the fermentation the sugar is converted into alcohol, which remains in the slices, and, on completion of this transforming process, the fermented slices are introduced into stills of a peculiar construction, and the alcohol drawn off by distillation. The residuary slices in the stills, having been subjected to the effects of boiling water, are too much saturated with water, and in too pulpy a condition, to be carted away for cattle food, with convenience or advantage, to a farm at some distance from the distillery; hence the cooked slices in the stills, after the extraction of the alcohol, have to be consumed by fattening cattle in the immediate neighborhood of the distillery."

According to the returns sent in, it appears that the roots manufactured into sugar and spirit gave, on an average, 7·09 per cent. only of sugar—a quantity much too small to render the manufacture of sugar from beet-root a profitable industry in Victoria. The average quantity of sugar contained in beet-roots used for the manufacture of sugar on the continent of Europe is 10–13 per cent. It is the object of the Government, I presume, when offering rewards for the encouragement of new industries, to ensure their permanent and profitable establishment.

Since the publication of the last Report of this department, delivery has been taken of the library and effects of the late Board of Agriculture, which were held in trust for the Government by the

Trustees of the Public Library and Museums. A number of volumes collected by the late Royal Commission for Foreign Industries and Forests have been transferred to the departmental library by His Honor Judge Bindon, Chairman of that Commission; and I have to acknowledge the presentation, on the part of Mr. Frederick Watts, Commissioner of Agriculture in the United States of America, of the monthly and annual reports of the Department of Agriculture of that country for 1872; on the part of Mr. W. H. Archer, Secretary for the Department of Lands and Survey,* of works relating to the preservation of food, the progress of Victoria, and the patents applied for and granted in this colony; on the part of the Acclimatisation Society of Victoria, of volumes 1 and 2 of its proceedings; and on the part of the Royal Agricultural Society of England, of a series of its journal from 1865 to 1873, inclusive. The departmental library now contains upwards of 200 volumes, exclusive of pamphlets and papers; but, owing to the want of accommodation in the office of this department, the cases which contain them have been unavoidably placed in different rooms of the Lands Department, wherever space for their temporary accommodation could be found, while the furniture has been lent to Mr. Byron Moore, for the temporary use of the Occupation Branch of the Department of Lands under his control.

Communications have been addressed to the Department of Agriculture of the United States, the Royal Agricultural Society of England, the Department of Agriculture of Buenos Ayres, the Highland and Agricultural Society of Scotland, and many other foreign departments and societies, requesting their co-operation with this department for the common object of the promotion of agriculture; and I am able to report that favorable replies have been received from all those who have as yet responded to the invitation of this department. It is not sufficient that an interchange of correspondence take place. This system must extend over a far wider field. It must, to be in the highest degree beneficial, embrace the interchange of the reports and other publications of this depart-

* Then Registrar-General.

ment with those of every foreign institution of its kind; also the exchange of seeds and other agricultural and forest products likely to be suitable for cultivation in or otherwise serviceable to Victoria. I have already acknowledged the receipt of two volumes from the United States Department of Agriculture, and several numbers of the *Journal of the Royal Agricultural Society of England;* and I have now the satisfaction to state that I have received from the former institution, in addition, four packages, containing smaller parcels of seeds of many kinds of maize and garden produce. These seeds have been distributed to a few careful and trustworthy persons in different parts of Victoria, who have kindly undertaken to grow them experimentally, and report to this department. But it is not sufficient that seeds obtained from foreign countries should be tested in this wise: a portion should always be grown under the immediate supervision of an officer of the department, and a careful record kept for comparison with the results obtained elsewhere. Such a course, however, is impossible at present, neither land nor assistance being at the disposal of the department. A plot of ground for experimental purposes, and assistance to superintend and direct the cultivation of the same, are urgently required; and I venture to express a hope that these may be supplied at an early date. This department, however, cannot hope to receive gratuitously new and valuable seeds from foreign institutions unless it is prepared to send others in return. I have been enabled, by the assistance of Mr. Guilfoyle, Curator of the Botanical Garden, to transmit to the Commissioner of Agriculture in America a collection of forty species of Australian seeds, and, by the help rendered by Mr. Ferguson, Superintendent of the Macedon State Nursery, to send seeds of thirteen species of Eucalyptus. I have likewise been enabled to obtain seeds of the Eucalyptus globulus (bluegum) and Eucalyptus rostrata (redgum), for the former of which the Commissioner made a special request, by defraying the cost of collection out of the "Incidental" vote of the department; but if this system of interchange is to be continued, it will be necessary to place a sum on the Estimates—say £100—to meet such expenditure.

The gradual development and growing importance of the Department of Agriculture demands that an economic and industrial museum should be added to it for the purpose of practically illustrating all matters relative to the art and science of production. Such museum should contain specimens of all substances appertaining to and dependent upon agriculture, correctly named and carefully catalogued, for the information of the public. It should include specimens of every soil, manure, or other substance analysed in the laboratory, to each of which should be attached a statement of its component parts and a brief description of its properties; also specimens of the insects injurious to vegetation, and likewise those which are beneficial to production, that the farmer, the gardener, and the forester may learn to discriminate between his foes and friends; also seeds of the more important cereal and other crops, models of the more desirable fruits, samples of the various agricultural products used in the arts and manufactures, and specimens of the fabrics, &c., made from them; it should form, indeed, a school for the study of the appliances used in the cultivation of the soil, the substances which the earth, by the application of industry and capital, is made to produce, and the fabrics into which these, by the skill of the manufacturer, are converted. I have endeavored to preserve specimens of the various plants, frequently supposed to be injurious to the health of stock, which have been forwarded to me, from time to time, for examination and report, as well as other substances of agricultural importance, but regret to be compelled to state that some of these have had to be rejected altogether, while others have been preserved only by the application of the strictest economy in the matter of space; indeed, the space assigned to the Department of Agriculture—viz., one small room in the Lands Department—is too limited for the requirements of any department of this Government. It is not only insufficient for its present accommodation, but it is a positive barrier to its development in useful directions. It is gratifying to me, however, to relate that there are now hopes of ample accommodation being made available. The building in Market square formerly occupied by the Telegraph Department, and at present temporarily by the

department of the Honorable the Commissioner of Trade and Customs, it is understood, will be handed over to the Department of Agriculture on the completion of the alterations to the Custom House that are now being made. Ample space will then be afforded for extension. A large room, admirably suited for a museum, will be available, and also accommodation for an agricultural library and reading-room, to which the public could have access at all times, for the purpose of gaining such information on agriculture and its allied sciences as they might desire to obtain. It will be necessary, however, to provide additional temporary accommodation until the building in question shall be vacated, which, I am given to understand, will not take place until about twelve months hence. The laboratory, which it is proposed to erect for the service of this department, I would recommend should be built on the piece of vacant ground adjacent to the building in question. By this means all the offices of the Department of Agriculture would be concentrated round one centre, an object in the highest degree desirable of attainment.

Another and very great benefit, I consider, would be conferred upon this department, and its usefulness largely augmented, were a sum placed on the Estimates—say £200—to enable it—in its infancy and when it cannot hope to possess a sufficient professional staff—to call in, when necessary, the advice and assistance of experts. I have already alluded to the desirability of engaging Mr. C. French to afford information on entomology. It happens, not unfrequently, that circumstances occur in the country districts which should be watched, investigated, and reported upon by the Department of Agriculture. We hear of new and extraordinary diseases breaking out among crops, of the appearance of supposed poisonous plants, of weeds in the vicinity of which cereals will not grow, of diseases which carry off large numbers of stock, and which were previously unknown; likewise the appearance of parasitic fungi on grasses and other crops, the detrimental action of which often impairs the yield of a district; and of many disasters of a like kind, all of which should be watched, and their progress and devastating influences recorded. I desire to commend this suggestion to your favorable considera-

tion, as, by its adoption, a vast amount of good, in my opinion, would be effected for a trifling outlay.

The provision of the Postal Act which provides that all letters transmitted through H. M. Post Office must be prepaid, acts prejudicially towards this department, and tends to limit its usefulness. It is highly essential that the Department of Agriculture should be kept informed of all matters which affect the agricultural interest, and which are of public importance. For the acquisition of such information, the department must always be dependent for the same to a great extent upon the persons who are settled on the lands of the colony, and under whose daily observation such matters of necessity must come. Particulars are already supplied, from time to time, regarding the condition of the crops, the devastating influence of insects, the peculiarities of climate, &c., by persons in different districts; and I am led to believe that, if the restriction regarding postage was removed, this means of obtaining information would be largely augmented. It frequently happens, too, that the Department of Agriculture has occasion to issue circulars to persons throughout the colony, requesting information on certain matters; for example, the increased attention given to the growth of any one crop, and the like. There seems to be a general desire on the part of the public to supply information of this description, but many are debarred from so doing by the outlay for postage which it involves; and they very naturally, I may say justly, affirm that, when information is supplied gratuitously to a public department for the public good, the Government, in their opinion, should permit the free transit of such information. It would greatly extend the usefulness of this department if an arrangement could be made whereby letters and packages addressed on service to the Honorable the Minister of Agriculture, or the Secretary for Agriculture, could be transmitted through the post free of charge; and I venture to express a hope that an arrangement may be made at an early date, whereby the farmers of the country may be placed in free communication with a department, which has been created for their special benefit.

It has suggested itself to me—and the subject is one which, I

think, comes strictly within the province of this department—that it would tend to much good hereafter, and serve as a basis for future taxation, were an agricultural survey of the country undertaken—if the lands of the colony were classified according to their natural capabilities. It seems to me a monstrous thing that a man who, by the combined application of industry, capital, and intelligence, has converted a barren schistose hill into a well-managed and productive vineyard, should be subject to a higher assessment, than the person who owns or occupies the adjacent lands of equal natural fertility, or than one who owns a vast extent of the most naturally productive lands of the colony, because such lands are devoted to none other than pastoral purposes. It seems to me that, under such a system a man's industry is taxed—not the land, which, by the application of such industry, is made to produce a higher return per acre than lands of equal or even greater natural productiveness. This subject is one which demands attention, for it lies at the foundation of the unlocking of a vast and in the highest degree fertile extent of our territory, and its application to more profitable ends.

Twelve months additional experience of this department has proved to my satisfaction that, if it shall serve efficiently the ends for which it has been created, it must receive more liberal support from the State. I find it quite impossible to work out these ends with the means at my disposal. The nature of my duties is such as to require my frequent attendance in the various agricultural districts, to note the advancement or retrogression that is being made, and the matters which demand most urgently the intervention and aid of this department. My time, at present, during the hours which may be said to belong to my office, is almost wholly occupied with correspondence, that increases in amount as the department becomes better known and more thoroughly appreciated, besides other routine official work; whereas the more important thought-demanding portion of my duties has had to occupy the moments of my leisure, and they have not unfrequently absorbed the whole time at my disposal. My assistance consists only of such as is afforded by one boy, who, though he is willing and desirous to please,

is too young and inexperienced to render material help; and when my duties demand my absence in the country for some days at a time, my office work accumulates to an extent which requires close application to overcome. I should, I respectfully submit, be relieved of all routine correspondence and mechanical official work, that my time might be devoted, with the least possible interruption, to the more important duties of my office—to the perfecting of schemes by which this department may be rendered increasingly useful to the community, and for its permanent yet gradual development. I would therefore beg to urge the imperative need for the placing at my disposal of a person thoroughly competent to undertake the duties above referred to—one who would be able, in my absence, to conduct the office work of this department, and thus render me more free to occupy my time with my professional duties, and prevent the delays, hitherto unavoidable, during my absence up-country.

In my last Report, I had the honor to refer to the desirability of placing the Department of Agriculture under the provisions of an Act of Parliament, and I beg to revert to my suggestion there made. I instanced, as a precedent, that a similar course had been taken in every other country where a Department of Agriculture had been created; and I am not aware that such course has proved unwise in any single instance. The want of a definition of the subjects over which this department shall have control, renders my path more difficult and more precarious, as, in the execution of what I deem to be the duties of the Department of Agriculture, I am liable to encroach upon the subjects of which some other department of the Government has control. I understand that an attempt is about to be made to establish a Department of Agriculture in New South Wales, and that the necessity for placing such department under the provisions of a liberal and comprehensive Act will not be overlooked.

In concluding this Report, it devolves on me to testify to, and gratefully acknowledge the assistance which has been afforded me, by the Surveyor-General and certain officers of his department, in the preparation of the illustrations which it contains; for had it not

been for the assistance thus rendered, it would have been impossible for me to have elaborated, or even published, certain important portions—Mr. Bacchus' paper on the native grasses, for example. I venture, however, to express a hope, that such facilities may be placed at the disposal of this department at an early date as will render it unnecesary for me to trespass on the time and resources of any branch of the public service.

I have the honor to be, Sir,
Your most obedient servant,

A. R. WALLIS,
Secretary for Agriculture.

REPORT OF THE CHEMIST.

Chemical Laboratory, Government House Domain.

Sir,

In submitting my report of work done in the Laboratory of the Department since my connection therewith, I would first direct your attention to the fact that it is a report of the operations carried out during barely four months, the actual work of analysis not having really commenced before the new year ; the short time at the end of 1873, after my taking charge, having been unavoidably consumed in furnishing the Laboratory with certain necessaries which were required to enable analytical research to be proceeded with. I may instance the laying on of water from the pipe in the new Domain road, the supply and erection of still for distilling water, erection of sand bath, &c., as well as supplying a fresh stock of re-agents and apparatus, all of which works take time, and have occupied a portion of the short space over which my report extends, and narrowed down the time of actual analytical work to a period which is quite inadequate for the supply of material for such a report as should be due from the officer under whose charge such an important branch of the Department of Agriculture is placed. When samples of soils are forwarded for analysis, it would render great assistance to the chemist in many cases, and add value to his report, if they were accompanied by as full particulars as possible, and upon all points likely to throw light upon any peculiar features observed, when examination is desired for the purpose of ascertaining the cause of any peculiarity.

The samples should be 3 to 4 lbs. in weight, taken from the surface to a depth of about 6 inches, with also, generally, a sample of the subsoil. The particulars should embrace information upon—

1st. Situation and Origin ; *i.e.*, if upon hill country, giving aspect ; or, if from level country, swamp, or alluvial land, giving, where known, geologic stratum from which derived.

2nd. If virgin soil, give information as to nature of trees and undergrowth, if forest ; or, as to sorts and feeding value of grasses, if open country.

3rd. If cultivated land, state how long in cultivation and present condition, &c.

4th. State any noticed peculiarity of climate.

5th. State fully any peculiarities observed, and what particular features it is expected that analysis will aid in elucidating.

My time has been chiefly occupied in the examinations of the samples of virgin soils collected by myself during my tour of inspection through the State Forests, and also of samples of soils sent in for examination and report; and also of samples of locally manufactured manures. Some smaller matters, as analyses of builders' sands, &c., &c., have also been undertaken, but are not of sufficient general interest to warrant my including them in this report.

Thinking that a few words in explanation of the results of examination into the composition, &c., of both soils and manures would render my report of greater value, I have embodied the analyses made, as illustrations, in the following papers :—"On Victorian Virgin Soils, and the relation of Chemical Analysis to Soils;" and on "Special Manures of Local Manufacture."

On Victorian Virgin Soils, and the Relation of Chemical Analysis to Soils.

"Agriculture" meaning, almost literally, the cultivation of the soil, in any enquiries having for their object the improvement of means to that end, the soil, as the basis upon which has been raised by slow degrees what may well be termed the "art" of land cultivation, would naturally take first place. The degree of development of this art in any country truly does not depend upon whether it be examined in the nineteenth or any earlier century, every country, permanently occupied ultimately, seeming to have to pass through the same routine of treatment, which may be divided into three easily recognised periods :— 1st. The exhaustion of the best and most approachable of its virgin soils by the earlier settlers. 2nd. A period during which these exhausted soils lie idle, whilst outside lands go through a similar process of exhaustion. And lastly. The time when population becomes sufficiently dense, and outside lands being unable to supply the demand for food, the cultivation of the old exhausted land again becomes profitable. Victoria is yet in the second period, but there are signs of the third being near at hand, making all allowance for possible disturbance of this natural sequence by importations from beyond the sea. And it behoves her inhabitants to look the fact in the face, that, with a rapidly

increasing population, the available area of virgin land suitable for the raising of grain is as rapidly diminishing. The result will be as in all other countries: a return to, and the proper cultivation of, the already so-called exhausted soils. The question of corn-growing is entirely one of £ s. d. So long as there is fresh land to be had for mere selecting, so long as there is land for the poorest selector, who necessarily looks to the earliest return for his outlay, and so long as the means of communication remain difficult, for that time must it be the case, that destructive exhaustive cropping pays those engaged in farming best, for the time being. It must be remembered that proper farming in all countries requires a comparatively large capital—larger in proportion to the returns than is probably necessary in any other business. In all new countries the class that engages in this industry is probably the poorest; and because it appears so easy to plough, sow, and reap a crop of wheat, this class—as a class—is also probably more ignorant than any other. So long as it only requires the most rudimentary knowledge, or the degree of cultivation practised by the Hindoos to raise a crop, all is well. But Victoria is fast getting beyond such a primitive state of things. Men still go further afield to fresh lands and struggle with the wilderness, for in their state of knowledge, or from want of capital, it is a necessity; but our more intelligent farmers are anxiously looking abroad for means that will enable them to increase the produce of their acres. They begin to feel that, with the increase of population, each acre must be made to produce more food than heretofore. At present they are in many districts most appropriately turning their attention to the production of meat. This being a slower process of exhaustion, and giving less trouble than corn-growing, finds favor for the time, and will in many districts naturally suited for pasture land continue to pay best for an indefinite period, with moderate top-dressing; but in most cases a combination of the two systems will be at last resorted to as the one most rational and most profitable, as returning the greatest amount per acre for the money expended, requiring, however, for its profitable pursuit, a liberal and intelligent treatment of the soil.

Several of the sciences have lent important aid to scientific agriculture, but none to such an extent as chemistry, which has of itself almost revolutionized the practice in the thickly peopled portions of Europe, from that which obtained a few years since. Nor could the artificial system now practised in the most celebrated agricultural districts have come into existence even without its aid. As such a system becomes necessary here, so will chemistry be required to direct it, to assist the practical man by answering interrogatories as to qualities

of manures, of soils, and of products, methods of application, of treatment, and processes of manufacture, so as to render him such information on—to him—obscure points as would assist him in his efforts to cause the land to yield its highest values; also by carrying out experiments on questionable points and publishing their results, thus preventing individual expenditure where such are proved failures; and again, in spreading information as to known successful processes discovered in one or other part of the world.

In Victoria the work for the agricultural chemist is already ample. The difficulty is rather to decide upon what should be undertaken first, although the present still existing primitive state of agriculture—what is termed "Colonial Farming"—is yet too much in the ascendant to cause the more scientific practices of older countries—so many of which are applicable already to this country—to carry much weight with so many of our sturdy settlers, who have, however, seen next to nothing beyond their experience of bush farming in Australia. Thus the agricultural chemist is as yet not called upon by the individual settler for information to the same extent as where farming has assumed a highly artificial character, and where such a person is become an absolute necessity.

The soil then being of primary importance to agriculture, the first work of general importance would appear to be a thorough examination, both chemically and mechanically of samples from all geological formations, and of all classes. This is a work of time and labor, but should be pursued contemporaneously with whatever special analytical work is required, occupying all spare time that can be devoted to it.

The following report upon Victorian soils cannot be more than a mere sketch of what an undertaking of such importance should be. The laboratory of the Department of Agriculture has been such a short time in existence that results of great value can hardly be looked for; and this report must be taken more as pointing out one direction in which the efforts of the agricultural chemist may elicit facts of value, with a few words upon soils in general and notes upon the peculiarities of those already examined as far as the few analyses completed may justify the forming of an opinion upon a soil of any particular class. The soils chosen for examination have, to the present time, been virgin soils from certain geological formations, it being deemed of more value in the present state of agriculture in the country to record the composition and state of the soils of different parts before they have come under the hands of the cultivator. Except in particular cases, the examination of

cultivated soils in general will become of greater value, as a more artificial, or rather improved, mode of treating the soil becomes necessary. A properly conducted series of analyses of virgin soils will then be of great value for reference for comparison on further analyses of the same soils being made after exhaustive cropping and restorative treatment. The present value of such analyses also must not be overlooked, as in many cases already selection of lands would, or would not, have been made had the intending selector been aware of the good or bad qualities of the land before his eyes. There is no doubt, in the majority of cases, a practical farmer can form a good opinion of land, especially if he have experience in Australian soils ; but all selectors are not practical farmers, and all farmers on selecting have not Australian experience. To both these classes of men analysis, combined with a thorough examination of the physical peculiarities of the country, would often save much, sometimes years, of profitless labor. What is more common in Victoria than to see a selector striving to battle with the evil qualities of the soil of his selection ; often truly such as no man of experience would attempt to cultivate, but at other times fair enough to look at, especially at the season of the year at which the choice was made, and yet more or less sterile, owing to excess of peaty vegetable matter or to the existence of some deleterious substance that is often instinctively felt by the man of experience in cultivation of Australian soils to be the case ? This man has a vague feeling of mistrust on viewing such a soil and the quality of its vegetation, for has he not seen similar soil cultivated with disastrous results ? Yet the active cause of sterility is unknown, and therefore the proper remedy ; and the man wanting experience spends possibly his all in repeating the same experiment tried by others previously upon similar land with like unfortunate results. Here chemical analysis is of great value in aiding in preventing such results, by confirming, if just, suspicions as to the condition of any soil that may be raised by its appearance, thus saving proof by experience—which means the expenditure of at least a year's labor and a year's living—by possibly a selector struggling to form for himself a home, with just sufficient means to enable him to make the attempt. The examination of virgin soils is of value for these two reasons, which must be apparent to the meanest capacity. But, without going into the minutiæ of chemical analysis, it is known by more advanced agriculturists that certain constituents are necessary in a soil in quantity, and in a certain condition, for the profitable cultivation of certain crops. In Victoria this fact has been stumbled upon by the practical man in many instances ; but though we view the successful instances, who has recorded the costly failures ? Not that

chemical analysis *alone* would ever decide upon the fitness of a soil to carry any particular crop, but it would often render invaluable assistance in preventing unprofitable trials ; in a like manner, as geology has prevented in numerous instances the sinking for coal where experienced miners have recommended its being done from the similar appearance of the country to that where they have been at work, but where the science of geology has shown that the surface stratum was one never found above the coal measures.

As a good illustration of this fact of the accidental or fortunate trial of a crop—and one but little grown ordinarily—upon a soil well adapted to it, and which suitability is fully borne out by the analyses already completed at the laboratory, may be instanced the pea crop, which is one somewhat extensively grown on the volcanic soils about Clark's Hill and Dean. The pea has always been recognised by chemists as a potash plant. In a late publication, M. George Ville, a distinguished French agriculturist, who has experimented for thirty years upon the mineral requirements of plants, states, as a result of his experiments, that potash exercises a "predominating effect" upon peas, beans, clover, vetches, sainfoin, lucern, flax, and potatoes. A glance at the analyses of such soils as will bear upon the question, viz., of the "later volcanic period," three samples, soil and subsoil, from Smeaton, will show the larger, comparatively, amount of potash to be found in them ; and bearing in mind that wheat is not a potash plant, it may be understood why in this neighborhood it has paid in many cases to take a crop or two of peas after the land has been exhausted for wheat—*i.e.*, a potash plant has succeeded where one requiring a supply of nitrogen in the soil has failed from the exhaustion of that element by successive crops. The luxuriance of clover and lucern on these soils also bears out the fact of the influence of potash, though, being crops of more general growth than peas, their success is not so noticeable.

We must, however, not expect too much from the chemical analysis of soils. The active ingredients of a soil are but a small proportion of the whole, the balance being made up of an inert mass which acts merely mechanically as a support to the plant and as a diluent, as it were, of the active particles, giving assistance also, as a porous body, by allowing the circulation of air and moisture, which are necessary to the roots of the plant, the first to yield up its oxygen for different purposes, the second to act as a solvent of the useful ingredients of the soil, thus enabling absorption by the spongioles of the rootlets to take place. It may well then be judged of what importance is the proper mechanical condition of a soil. Chemical analysis may state that a soil contains all

substances necessary, and in a proper state, for the growth of a crop, but by bad mechanical condition the crop may be prevented taking advantage of the probably very favorable condition of the soil exhibited by the chemical analysis. For instance, hardness of surface may prevent percolation of the water necessary to dissolve the substances noted as being present, or, possibly, excess of water precludes circulation of air, or, by being insufficiently worked-down at seed time, the soil remains in too porous a condition, so that the falling rain percolates too quickly through the cultivated stratum, an ensuing drying wind perhaps rapidly depriving it of all moisture, either killing the young plant or seriously checking it.

It matters little in such cases whether potash or nitrogen is in abundance, or whether we are in ignorance of the value of the one or the other element to certain plants. To be of value—to even give intelligible results—chemistry must go hand-in-hand with the mechanical treatment of a soil. Thorough cultivation is the essence of good farming, and, aided by chemistry especially, is justly elevating *rural economy* to the position of a science.

Again, it is probably generally known that all the materials required by plants are contained in every soil almost without exception, and as it is also known that chemistry discovers what quantity of each substance exists in the soil and what is yearly removed by cropping, it is often thought that, given both these quantities, it should be easy to find out what element is deficient. This is a fallacy that has been followed by many men of intelligence, who have not taken sufficiently into consideration the many points bearing upon this relation of the elementary substances in plants to the same elements existing in the soil. Bearing in mind what has been said as to mechanical condition of soil, there must also be noticed in any inquiry upon this subject:—1st. The conditions in which the elements are taken up by the plant and assimilated, and the condition of those elements found in the soil. 2nd. The peculiarity of the particular plants, habit of rooting, whether a surface or tap-rooted plant—as a plant like lucern, or the field bean, or sainfoin, drawing its mineral constituents chiefly from a depth, could not influence so much the quantities of those constituents existent in the surface soil as a plant like the field pea. 3rd. Even if we have accurate analyses of the amounts of certain elements soluble in water, and therefore in a condition to be absorbed by the roots of plants, it would be also necessary to know the amount of the insoluble portion of the element also existing, and which, being rendered soluble by different influences, is an ever-varying quantity; because by application of manures—

as lime, &c.—by increase of vegetable matter, and by increased oxidation on improved aeration, more rapid chemical changes take place ; so that to be of value in this direction frequent and most minute analyses must be made. The very small quantities of the really valuable elements in a soil in an available state may be also an objection, as a very minute error would neutralize a large amount of troublesome investigation ; but this would be no difficulty if the quantities originally existing in a certain state were *fixed* quantities. Therefore, for these reasons also, too much stress must not be laid upon the value of chemical analysis of soils as *being of itself* the great desideratum, by the aid of which alone the farmer will be enabled to raise his crops of the greatest perfection with the least expenditure. A glance at the above reasons will explain to the farmer the difficulties surrounding the application of pure chemical investigation in this direction to his professional duties ; and also those previously stated in favor of the necessity of soil analysis will also show its value when taken in a broad light in its proper position as related to agriculture. In the analysis of manures, of feeding materials, and of such products of cultivation as sugar-yielding plants, or those producing dyes or oils, whose values depend upon a semi-chemical method of treatment, the value of the chemist's work is directly apparent, and results seem of more direct value than the equally interesting but more obscure and laborious inquiry into the ultimate composition of plants and soils, and their relation to one another. But though the ability to show large practical results that are apparent to all capacities is naturally an object to the agricultural chemist, the most important chemistry of the plant and of the soil must not be overlooked.

As has been mentioned, plants contain certain mineral constituents, which they necessarily derive from the soil, as well as certain other elementary substances taken up in different proportions from the soil and the atmosphere. The constituents derived from the soil exclusively are potash, soda, magnesia, lime, iron, silica, chlorine, phosphoric acid, and sulphuric acid.

Traces of other elements occasionally exist, but the above are invariably found in all plants. The elements absorbed from both soil and atmosphere are carbon and the gases oxygen, nitrogen, and hydrogen.

It is necessary in all cases that, before any of the mineral substances can be absorbed by the roots, that they be in solution. Therefore the measure of any one of these substances in a soil available for plant use, is just that quantity existing in solution, and as all these substances exist both in a soluble and insoluble state, it can be readily understood that the mere application of one of them to a soil deficient in that

particular substance is not sufficient. To be of value at once the substance must be soluble in water, or water containing carbonic acid.

It will be well, before examining the condition of the elements in soils, to inquire in what states they are absorbed by the plant. It is found that the alkalies, potash and soda, are taken up in combination with one of the acids or with chlorine; lime, with carbonic acid as calcic bicarbonate, or with phosphoric acid in conjunction often with magnesia, originating from bone-earth. Gypsum also is to some extent soluble in water, and where it exists may supply a portion of the lime required, as well as sulphuric acid. Iron is always found in small quantities in plants, has several soluble salts, but is so universally distributed as to be of small importance in treating of soils, though, from its presence always in the blood of animals, it would seem to be a necessary ingredient in plants. Silica is the last important mineral constituent. This substance enters the plant in combination with the alkalies, potash or soda, from which it is deposited in the shape of scales or plates upon the outside of the stem of cereals, grasses, &c. These compounds are obtained entirely from the soil. The remainder, which form by far the larger portion of plants, are absorbed partially from the soil and partially from the atmosphere, different plants acquiring their supplies from these sources in different proportions. Hydrogen and oxygen are absorbed by the roots as water, chiefly as a solvent for mineral salts, and it has been calculated that 2000 parts of water pass through a plant for every part of solid matter fixed. Nitrogen, a most important element, is absorbed chiefly in conjunction with oxygen as nitric acid. Carbon is but to a small extent taken up from the soil, the great bulk being absorbed by the leaves from the atmosphere, where it exists as carbonic acid gas; its presence in the soil is, however, of great value, from the solvent powers of carbonic acid when in solution in water.

We want then, in our soil, to make it fruitful, a sufficient supply of potash, soda, lime, silica, phosphoric and sulphuric acids, and chlorine, and also nitrogen as nitric acid. These must all be in a soluble state, and it will also be necessary that there exist a sufficient quantity of water to hold them in a properly dilute solution, that they should readily pass into the circulatory system of the plant. The soil itself, too, must be so loose and porous that circulation of air take place, and yet so consolidated that the plant is firmly held in position, and that water be retained in sufficient quantity. On the other hand, there must be an absence of deleterious substances, as, for instance, iron, in the form of ferrous oxide or ferrous sulphate—in quantity—or of soluble metallic salts, excess of vegetable matter in an unhealthy state, as peat, presence

of sulphur in combination with hydrogen, as hydro-sulphuric acid gas, or of carbonic acid gas in excess to the exclusion of atmospheric air.

If all these conditions be favorable, our soil will be fruitful if properly cultivated. Soils naturally, as a rule, do contain a sufficiency of the compounds of the required elements in a proper condition; some are, however, deficient of one or other, either almost entirely or to such a degree as to render them infertile for certain crops upon which that element exerts a "predominating effect." Virgin soils also very often contain vegetable matter in an unhealthy condition, iron, as ferrous oxide, &c., &c., due to absence of aeration of the soil during the ages of their formation. This is almost universally the case in Victoria, owing to there being only minute quantities of lime existing in the soils over the great bulk of the area of the country, but only occasionally to any injurious extent, chiefly in such cases being wet tenacious forest or swampy land. Lands actually wanting certain elements are not of frequent occurrence. Drift sands and certain felspathic clays, or peats even, may present this peculiarity; but not being likely to tempt people to cultivate, are not of interest. The great bulk of soils then do contain all the elements of fertility, in different degrees, however. As soils are formed by the decomposition of rocks of different origin, and partake necessarily of the character of the rocks from which they are derived, so the proportions of the several constituents differ in soils, depending upon the geologic stratum from which they originated.

Thus a soil formed by the decomposition of a volcanic rock differs in certain particulars from one formed from a sedimentary rock, a limestone soil from a sandstone soil, and both from one derived from a clay slate, or from an alluvial soil made up of a mixture of detritus from two or more strata.

The following analyses of soils of volcanic, of sedimentary, and of alluvial origin—the latter having been deposited by a stream flowing through country situated upon both the other strata, and therefore carrying with it particles from each—will illustrate this statement.

These samples may be said to be extreme examples of soils derived from silurian schists and felspar porphyry; but comparing the chemical and mechanical analyses of the two, we can recognise the existence in the first of very finely divided particles of silicious matter, by the percentage of impalpable sand in the mechanical, and the small amount of alumina in the chemical analysis, evidencing origin from a sandstone stratum deposited in deep water; whilst the amount of alumina in the volcanic soil, with the mere trace of lime, is fair

evidence of its owing this condition to its derivation directly from a felspathic rock. The coarseness of particles shown by the large percentage of gravelly and coarse sand, supposing the 25 per cent. of organic matter be left out of the calculation, showing that the original rock is made up in part by silica—quartz—in large grains, as well as that water has had some effect in washing away the finer particles, leaving a large proportion of the undecomposed rock behind as rough-grained sand. The alluvial soil also shows that, to the sandy particles of the schistose soil the depositing stream carries with it, a certain amount of alumina is added from the volcanic country through which it also passes. The large proportion of coarse sand and gravelly sand is here evidence of deposition with water action, differing, however, in its nature from that which has to some extent aided in causing similar proportions to exist in the sample of volcanic soil, the water action in the latter case being the washing away of the finer particles by rain, the sample having been taken from the summit of the range.

Chemical Analyses.

100 *parts of Soil dried at* 212° *F. contain*—

	Sedimentary.	Volcanic.	Alluvial.
Organic matter and combined water ...	5·290	27·320	10·345
Silica and insoluble silicates	89·820	50·792	79·200
Oxides of iron	1·650	5·206	3·364
Alumina	2·506	15·934	6·039
Soluble silica	·120	·255	·300
Lime	·145	·053	·154
Chlorine	·009	·012	...
Phosphoric acid	·047	·163	·072
Potash	·080	·070	...
Soda	·247	·226	...
Traces of magnesia, sulphuric acid, carbonic acid, and loss	·086	...	·526
	100·000	100·031	100·000

Mechanical Analyses.

Air-dried Soil.

	Sedimentary.	Volcanic.	Alluvial.
Water driven off at 212° F.	1·010	7·343	2·353
Organic matter and combined water ...	5·238	25·520	10·110
Gravel	...	...	...
Gravelly sand	·707	4·827	6·521
Coarse sand	47·557	40·059	62·446
Fine sand	16·755	2·671	4·628
Impalpable sand and clay	28·733	19·580	13·942
	100·000	100·000	100·000

The following analyses are of samples of soils from the upper silurian formation, both from the surface (to a depth of six inches) and from the subsoil, which in these cases, though at no great depth from the surface, is yet close to the rock, and may be considered to be samples of disintegrated rock in progress towards the condition of the surface soil, the chief points of difference being the addition of organic matter, and the loss, by exposure to rain, of finely divided clayey substance.

SOILS DERIVED FROM THE UPPER SILURIAN SCHISTS.

Dried at 212° *F. contain in* 100 *parts*—

—	Soil from Healesville.	(2.) Subsoil of No. 1.	(3.) Soil from near Marysville.	(4.) Subsoil of No. 3.	(5.) Crab-holey Soil, Healesville.	(6.) Subsoil of No. 5.
Organic matter* and combined water	5·290	3·200	8·140	5·160	5·485	3·857
Silica and insoluble silicates	89·820	87·764	78·950	80·800	88·595	89·407
Soluble silica	·120	·120	·138	·260	trace	·110
Oxides of iron	1·650	3·770	4·080	4·800	4·889	6·152
Alumina	2·506	4·432	8·000	8·280		
Lime	·145	·089	·083	·146	·059	·050
Chlorine	·009	·012	·005	·002	·008	·003
Sulphuric acid	...	...	...	...	trace	...
Phosphoric acid ...	·047	trace	·051	·070	trace	trace
Potash	·080	·613	·101	·075	·180	·070
Soda	·247		·219	·286	·210	·133
Traces of magnesia, carbonic acid, and loss ...	·086		·233	·121	·574	·218
	100·000	100·000	100·000	100·000	100·000	100·000
Specific gravity ...	2·238	...	2·118	...	...	...
Reaction	acid	acid	acid	acid	acid	acid
* Containing Nitrogen	...	...	·167	...	...	...

The soils from both Healesville and from Marysville are of the ordinary type of silurian soils, lightish-brown in color, not very friable, but with very finely divided particles. The depth, in both cases, is not great, the subsoil containing particles of the subjacent rock in the case of the Marysville sample, else differing chiefly in the amount of organic matter from the surface soil. Though not soils of first-class quality, they are not worthless, the chief objection to them being their small depth upon the rock. The amount of alkalies is very fair, and, with irrigation, such soils would yield good crops of all potash plants. Lime is deficient in

quantity, though it is present in larger amounts than in soils derived from the volcanic rocks. The following mechanical analyses of these soils will show the state of division of the particles comprising them. The amount of water, it will be observed, is small. The samples used in these analyses are merely air-dried, and the amount of water driven off by heating to 212° F. gives a very fair idea of their hygroscopic properties, quite as good for comparison as any other means, the amount of water vapor existing in the air at the time of the experiment always affecting the comparative results. It will be noticed that the amount of water, and the specific gravity of a soil, are in direct relation to the amount of organic matter, which exerts a very powerful influence upon a soil for good or evil.

MECHANICAL ANALYSES OF SOILS FROM UPPER SILURIAN SCHISTS.

Air-dried Soil contains in 100 *parts*—

—	Soil from Healesville.	Subsoil from Healesville.	Soil from Marysville.	Subsoil from Marysville.	Crab-holey Soil.	Crab-holey Subsoil.
Water driven off at 212° F.	1·010	·600	1·653	1·343	1·100	7·060
Organic matter and combined water	5·238	3·176	8·006	5·040	5·320	3·450
Gravel	...	...	...	...	...	...
Gravelly sand	·707	·670	·852	·352	6·372	4·814
Coarse sand	47·557	57·250	44·488	39·133	35·916	36·298
Fine sand	16·755	17·366	11·800	13·338	17·097	17·363
Impalpable sand and clay	28·733	20·938	33·201	40·774	34·195	37·015
	100·000	100·000	100·000	100·000	100·000	100·000

Soils formed by the disintegration of volcanic rocks differ very considerably from these. The most marked difference consists in the very much larger amounts of vegetable matter found in those of the older volcanic period. These samples, as well as 3, 4, 5, and 6 of the samples from the silurian, were taken from forest land, so that the rates of accumulation may be fairly compared. Those of the later period were taken from the open country about Smeaton, and cannot be compared on this point.

This vegetable matter, from the porous nature of the volcanic soils, is in a more or less healthy condition, causing the surface soils to assume the rich-looking dark-brown loamy appearance usually compared with "garden mould" as the most fertile of all soils; and though the

amount is excessive in some cases, as for instance in the soil from the summit of the Black Spur, it exerts a beneficial influence in several ways.

Vegetable mould, decaying organic matter, or humus, acts beneficially: 1st. By the process of oxidation, its carbon with the oxygen of the atmosphere forms carbonic acid, which we have seen gives a greater solvent power to water charged with it; 2nd. It has the power of absorbing from the atmosphere small portions of ammonia (a chemical compound of nitrogen and hydrogen), which exist; and also small quantities of water, thus giving hygroscopic qualities to a soil; and 3rd. Besides improving the mechanical condition of the soil, the color it imparts causes greater absorption of the sun's rays; and, being a slow conductor of heat, a dark vegetable mould is always a warmer soil than one deficient in organic matter.

It will be also observed in the following analyses that the amounts of the oxides of iron, and alumina, the basis of clay, are in much larger quantity. The first gives the dark-red color to the volcanic soils of the country, and is the cause of the "chocolate" tint that seems to be considered a certain warranty of the high quality of the soil. As volcanic soils are, as a rule, good soils, the test applies practically, though chocolate-colored soils differ much in quality, and one of the favorite color may be of far inferior value to a neighboring soil of a light-brown tint, derived from hills of a different formation. The ferric oxide, which is the origin of the chocolate color, is of no value in the soil in such a large proportion, and as other soils than volcanic may have the same color and be of inferior quality, something beyond judging by mere color is necessary when making choice of land. The amount of alumina in these soils is large, giving them somewhat the character of argillaceous (clayey) soils. Clay acts beneficially in many ways, when it exists in an ameliorated condition, when it is not in a sour state, as in some plastic clays. It retains ammonia and other valuable substances, contains within itself a certain amount of potash, which may be liberated in a soluble form, especially by burning, and it also gives stability, and a good root hold, to surface rooting plants. Clay is essential to a good wheat soil. The next constituent of volcanic soils worthy of note is lime. This substance is of absolute necessity in a fertile soil, is also of almost universal distribution, though it would be difficult to find a number of soils in any part of the world so deficient in this respect. In this peculiarity, soils from the later volcanic rocks resemble those from rocks of older date, and it is somewhat remarkable to find an ordinarily common substance like lime occupying such a position, one generally filled by such a valuable con-

stituent as phosphoric acid. This acid, on the contrary, seems to exist, as far as these soils have been yet examined, in fair to considerable, and even large quantities, compared with the percentage usually found in ordinary soils in Great Britain, where it but very seldom exceeds a very few hundredths per cent., whilst in the few soils analysed the amount reaches as high as ·163 per cent. The alkalies are also good in these soils, and their condition, both chemical and mechanical, points to a state of great fertility.

SOILS OF VOLCANIC ORIGIN.

Dried at 212° *F. contain in* 100 *parts*—

	Older Volcanic.				Later Volcanic.		
	Soil from Black Spur (summit).	Subsoil from Black Spur (summit).	Soil from Black Spur (lower elevation).	Red Subsoil from Black Spur (lower elevation).	Soil from Smeaton.	Subsoil from Smeaton.	Cultivated Soil from Smeaton.
Organic matter* and combined water ...	27·320	21·265	18·060	13·000	10·498	9·625	10·963
Silica and insoluble silicates	50·792	54·341	57·360	55·755	69·790	64·627	69·709
Soluble silica ...	·255	·296	·150	·069	·514	·448	·374
Oxides of iron ...	5·206	23·336	6·960	8·817	18·378	24·512	18·411
Alumina	15·934		16·465	22·135			
Lime	·053	·058	·068	·054	·115	·116	·044
Chlorine	·012	·007	·011	·006	...	...	...
Sulphuric acid ...	...	...	...	...	...	...	...
Phosphoric acid ...	·163	·141	·035	trace	·053	·050	·069
Potash	·070	·045	·115	·096	·167	·185	·364
Soda	·226	·255	·331	·190	·220	·165	·118
Traces of magnesia, carbonic acid, and loss	...	·256	·445	...	·265	·272	...
	100·031	100·000	100·000	100·122	100·000	100·000	100·052
Specific gravity ...	1·882	...	...	...	...	...	2·088
Reaction	acid	acid	acid	acid	acid	acid	acid
*Containing Nitrogen	·631	...	·360	...	·278	...	...

MECHANICAL ANALYSES OF SOILS OF VOLCANIC ORIGIN.

Air-dried contain in 100 *parts—*

—	Older Volcanic.			Later Volcanic.		
	Soil from Black Spur (summit).	Soil from Black Spur (lower elevation).	Red Subsoil from Black Spur (lower elevation).	Soil from Smeaton.	Subsoil from Smeaton.	Cultivated Soil from Smeaton.
Water driven off at 212° F.	7·343	3·940	4·380	4·210	4·612	3·640
Organic matter and combined water	25·520	17·308	12·458	10·075	9·199	10·565
Gravel	...	...	...	1·562	2·343	·531
Gravelly sand	4·827	5·038	2·222	3·652	1·617	2·344
Coarse sand	40·059	47·705	43·893	38·185	33·111	41·440
Fine sand	2·671	6·255	16·977	9·179	5·633	7·621
Impalpable sand and clay	19·580	19·754	20·070	33·137	43·485	33·859
	100·000	100·000	100·000	100·000	100·000	100·000

But a few words will be necessary in explanation of the several analyses of alluvial and mixed soils. The first—soil and subsoil—from the valley of the Watts River, are derived entirely from the volcanic ranges ; the subsoil being similar in appearance to the red "porphyritic" soil of the ranges, but showing different composition in its higher percentage of silica and less alumina, though evidently deposited with but little water action, differing much in this particular from its surface soil, which contains twice as much organic matter and only half the amount of alumina, the mechanical analysis showing the comparative coarseness of its particles. The soils from the Steavenson River and from the Graceburn are of mixed origin, and are of very similar composition, though they differ in appearance and in coarseness of grain, owing to the difference in the porphyries in the two districts. The soil from Coranderrk Station is a favorable specimen of a good useful soil, both mechanical and chemical analysis exhibiting many good points. It is not truly an alluvial soil, though of mixed origin, and must have been very gradually deposited rather than by the action of a swift-flowing stream, as in the case of the two soils just noticed. This sample was taken from a part of the hop grounds planted in the spring, and is, as the whole of these samples are, virgin soil.

Alluvial Soils, etc.

Dried at 212° F., contain in 100 parts—

—	Of Volcanic Origin.		Of Volcanic and Silurian Origin.		
	Soil from valley of the Watts River.	Subsoil from valley of the Watts River.	Soil from the valley of the Steavenson River, Marysville.	Soil from the valley of the Graceburn, Healesville.	Soil from the Hop Grounds, Coranderrk.
Organic matter and combined water*	18·800	9·118	9·110	10·345	10·660
Silica and insoluble silicates	67·444	65·021	78·062	79·200	70·850
Soluble silica	·280	·260	·404	·300	·320
Oxides of iron	12·462	24·935	3·290	3·364	5·320
Alumina			8·382	6·039	11·979
Lime	·146	·087	·106	·154	·067
Chlorine	·014	·012	·003	...	·031
Sulphuric acid	...	...	...	...	trace
Phosphoric acid	·072	·049	·047	·072	·211
Potash	·149	·126	·042		·041
Soda	·464	·219	·266	·526	·273
Magnesia, traces of carbonic acid, and loss	·169	·173	·288		·248
	100·000	100·000	100·000	100·000	100·000
Specific gravity	1·953	2·111	2·161	...	...
Reaction	acid	acid	acid	...	acid
* Containing Nitrogen ...	...	...	...	...	·336

Mechanical Analyses of Alluvial Soils, etc.

Air-dried, contain in 100 parts—

—	Of Volcanic Origin.		Of Volcanic and Silurian Origin.		
	Soil from the valley of the Watts River.	Subsoil from the valley of the Watts River.	Soil from the valley of the Steavenson River, Marysville.	Soil from the valley of the Graceburn, Healesville.	Soil from the Hop Grounds, Coranderrk.
Water driven off at 212° F. ...	4·320	4·333	3·025	2·353	2·980
Organic matter and combined water	18·040	8·720	8·844	10·110	10·305
Gravel	...	...	...	...	...
Gravelly sand	7·983	1·430	11·417	6·521	·670
Coarse sand	50·000	38·865	52·957	62·446	34·424
Fine sand...	8·394	18·088	6·967	4·628	12·106
Impalpable sand and clay ...	11·263	28·564	16·790	13·942	39·515
	100·000	100·000	100·000	100·000	100·000

It will be as well perhaps, before concluding, to say a few words upon the causes of sterility of soils and the remedies for this state. We have already seen that soils may be deficient in one or more substances necessary to the life—or at least for the healthy growth—of a plant, and as certain substances exert a greater influence on some plants than on others, a soil may be infertile for one plant and yet support one of a different species in a healthy condition. Such soils are only partly barren, and may be rendered perfectly fertile by application, in the shape of certain manures, of the absent substance. The same result follows where certain necessary substances, though existent, are not in a fit state for absorption by the roots and assimilation by the plant. But very different is the case where poisonous matters exist in the soil, or where exceeding bad mechanical condition is present, with the absence in a soluble condition in sufficient quantity of one or more of the necessary substances before mentioned.

Soils which are but little else than beds of drift-sand, and the so-called "peaty" soils, are instances of bad mechanical condition, together with an absence—either total or nearly so—of essential salts or acids. In these cases amelioration of the mechanical condition is primarily necessary, by the addition of clay to the sand and of calcareous matter to the peaty soil. Bad mechanical condition alone is sufficient in some instances to cause sterility, as in heavy plastic clays, where their nature is such that aeration is not possible, until the condition of the clay is improved. In this case, burning a portion of the clay soil and spreading the ashes, and the application of organic matter, will act most readily. In all these instances cure is possible, if it be considered that the land will bear the expense of treatment, which is always large where mechanical improvement is necessary. But where actually poisonous substances exist, the case is different. Fortunately, such instances are rare, and where the deleterious substances are the salts of metals—as copper—or due to the existence of such valuable commercial substances as the mineral oils, &c., the sterility of the soil is of little account. Other instances occur, as the alkali plains of the United States, or salt plains, once probably the bed of inland seas.

In all these cases the sterility is permanent; but as the appearance of the surface in such spots plainly shows the uselessness of attempting cultivation, such districts are either abandoned to the miner, or left in their pristine state of sterility.

Far different from this state of things is the case of a soil being more or less sterile from the existence, in certain quantities, of substances in a poisonous state, owing to bad mechanical condition preventing aeration,

and to the want of basic substances to form useful salts with the excess of acids existing therein. The two elements which are most often found in a state in which they act as poisons to plants—though when in other combinations they are most useful—are sulphur and iron. Iron exists combined with one equivalent of oxygen as ferrous oxide—in which state it is very injurious to vegetation—and combined with oxygen in the proportion of two of iron to three of oxygen, when it has the rust-red color so well known; in this state it acts beneficially. Sulphur exists combined with iron as iron pyrites; in this state, being insoluble, it would do no harm if it remained in that condition, but it is certain to become decomposed when existing in surface soil in contact with oxygen. The sulphur and iron both become oxidized, forming a new compound, the ferrous sulphate, or green vitriol, which is also most injurious to plant life, if in quantity.

Where oxygen is deficient in a soil, the sulphur often combines with hydrogen from decaying vegetable matter—also suffering from want of oxygen, to aid the process of decay—and forms hydro-sulphuric acid, which too is poisonous. Where then there is absence of oxygen in a soil, combinations of iron and of sulphur are formed that are highly injurious; not to mention the necessity that there should always be oxygen in the soil, else the roots of a plant will not penetrate, suffering, in the case of total absence of atmospheric air, as certain suffocation as if the whole plant were immersed in an atmosphere of nitrogen or hydrogen. Ferrous sulphate, on the other hand, is not formed where there is present such a powerful base as lime, which, by uniting with the sulphuric acid, prevents its union with the iron.

A case where partial sterility is caused by want of aeration, excess of peaty vegetable matter, and the presence of iron, as ferrous oxide, has come under notice already, samples having been sent to the laboratory for analysis and report. The analyses and extracts from the report it may be of interest to transcribe, as showing an actual case where the cause of and remedies for sterility of soils of most favorable appearance may be accurately pointed out.

These soils were surface soils, evidently bush land, from the presence of wiry grass stems and roots of ferns, though a weakly plant of clover here and there appeared. Nothing in their appearance would cause one to think they were other than somewhat sour, ordinary, uncultivated soils. They gave, on analysis, the following results :—

MECHANICAL ANALYSES.

Air-dried Soil.

——	No. 1.	No. 2.	No. 3.
Water driven off at 212° F.	10·040	3·400	3·300
Organic matter and combined water ...	21·261	10·541	11·923
Gravel	·150	...	1·000
Gravelly sand	·326	·235	1·143
Coarse sand	20·773	36·396	44·020
Fine sand	13·670	18·938	11·883
Clay and impalpable sand	33·780	30·490	26·731
	100·000	100·000	100·000

CHEMICAL ANALYSES.

100 *parts dried at* 212° *F., contain of—*

——	No. 1.	No. 2.	No. 3.
Acids of humus	3·000	3·367	·624
Other organic matter and combined water ...	20·388	7·527	11·692
Silica and insoluble silicates	57·522	80·800	74·360
Alumina	12·005	3·868	6·806
Oxides of Iron { Ferrous oxide	3·297	2·196	2·602
Oxides of Iron { Ferric oxide	2·424	·908	2·987
Soluble silica	·267	·294	·305
Lime	·267	·296	·292
Phosphoric acid	·050	·057	·047
Sulphuric acid	·286	·096	trace
Chlorine	...	...	...
Potash and soda	·444	·350	·243
Carbonic acid and loss	·050	·241	·042
	100·000	100·000	100·000
Specific gravity	1·760	...	...

No. 1 is a dark-colored, not very friable soil. From the very large amount of vegetable matter, and the fineness of its particles, as exhibited by the mechanical analysis, its deposition may be deemed to have taken place with but very little water action, it being much akin to soils of a swampy origin ; is probably low-lying, and suffers from want of drainage, The amount of vegetable matter (23·388 per cent.) is extremely large. and approaches the amount found in peaty soils, and with water (10 per cent.) makes up one-third of the weight of the air-dried soil. The condition of the vegetable matter is also unhealthy, there being much too large a percentage of acid or sour humus, owing to want of sufficient aeration. The existence of so large a proportion of the acids of humus in a soil is of itself sufficient to prevent a healthy growth of any but the

sourest kinds of herbage upon its surface. But on examination of the chemical analysis other deleterious substances may be noticed, viz., ferrous oxide and sulphuric acid, which, when existing in quantity, are of a highly injurious character. The former, the first oxide of iron, always exists where, iron being present, air is not able to penetrate. The bluish-green color of many clays at a depth from the surface is owing to its presence; and where it exists in even moderate proportions it is very inimical to all plants, and destructive to any but those of the coarsest description and of no feeding value. Such amounts as 3·297, 2·196, and 2·60 per cent. in a soil are quite abnormal, and positively poisonous to vegetation. Were these obnoxious substances absent, the soil possesses every constituent and condition to render it one of high value.

No. 2 is a friable sandy loam, resembling No. 1 in the fineness of its particles, but having silica in the place of the larger quantities of organic matter and alumina of the first. Humic acid and ferrous oxide are in excess here also.

No. 3 is a reddish-colored loam, and would appear to be in a more healthy condition than Nos. 1 or 2. Its component particles are larger, and it should not be difficult to cause sufficient aeration and oxidation. The amount of ferrous oxide is not so large a proportion of the total quantity of iron present, though still abnormal, and sufficient to explain any deficiencies in the fruitfulness of this soil.

The remedies for this unhealthy state are—

1st. Draining.
2nd. Application of quicklime.
3rd. Application of marls or other substances containing lime, or of wood-ashes.
4th. Paring and burning the surface, and spreading the ashes.

The last three applications being made in conjunction with breaking up the surface and cultivation, to have the greatest effect.

Proper drainage is certainly the chief remedy. A thorough system of tile and surface drains being what is required; though, as tile drainage is expensive, good deep surface drains, coupled with a good dose of lime on breaking up, may secure an effectual cure. In either case the cure could not be expected in one season or two, though great improvement would undoubtedly result, as the process of oxidation is a slow one.

The action of drainage would be in first removing the superfluous stagnant water existing in the soil at a depth, the place of this being naturally occupied by water percolating from the surface, which water

at present evaporates, giving rise to a low surface temperature. The percolating water always carries with it oxygen gas, and, therefore, the more perfect the system of drainage, the more rapid the circulation of water, and the sooner the proper aeration of the soil, and the oxidation of its poisonous constituents into harmless or useful substances, as well as the removal of much of the obnoxious salts in solution in the water running off in the drains, takes place.

The special value of lime as an application would be from its action upon decaying vegetable matter—causing decay to proceed much more rapidly—and in neutralising acids generated during this process, &c.

Marls and other similar substances act in like manner, but much more slowly. Paring and burning would act specially in destroying vegetable matter by fire, and furnishing, in the ashes of the portion burned, bases which act beneficially in neutralising acids in the remainder of the soil. Cultivation also acts by enabling air to penetrate the soil to the depth broken up, but is slow in effect, and only of use to a small depth, the roots still being liable to penetrate to the poisonous subsoil. These three remedies in conjunction—viz., drainage, lime, and cultivation—would soon correct the bad qualities of these soils, and render them of at least average fertility.

So far has the means at disposal warranted expression of opinion upon the qualities of these virgin soils of Victoria, and in comparing results of analyses of soils derived from different geologic strata. The number of samples examined is as yet too few to warrant speaking conclusively as to any peculiarity of any class of soils; and the number of strata the soils of which have been as yet analysed is too insignificant to render the preceding paper more than it at the outset professed to be, merely an intimation as to one direction, amongst many, in which the energies of the agricultural chemist may be profitably employed.

On Special Manures of Local Manufacture.

In the existing peculiar state of the market, a few words seem desirable in illustration of the value of manures manufactured in Victoria, samples of some of which have been analysed in the laboratory; and also upon the export to many foreign countries of material that, in all lands having to support a large population, forms an article of import of great moment. The progress of this country should surely be sufficiently advanced to have created a local market that should require for its satisfaction all the powers of existing manufactories, rather than that these should be kept going to supply a demand from other countries for

substances that should never be sent abroad in such a shape, which practice only obtains in the earliest period of national existence. It is to be hoped that the establishments now exporting so largely will, in the not distant future, manufacture for local requirements only. If it pay Tasmania and New Zealand, not to mention Great Britain, Natal, Ceylon, the Mauritius, &c., &c., to pay carriage and charges on Victorian made manures, it is to be expected that farmers more favorably situated will take advantage of their position to a greater extent.

By the term manure is understood a substance that contains such elements as the soil to which it is to be applied either is, or is presumed to be, deficient of entirely, or not to contain them in sufficient quantity for the profitable growth of a certain crop. A "manure" may also act chemically by releasing certain necessary elements already existing in the soil, from a state in which they are not available for the use of plants, to one more suitable to their requirements ; but the former meaning is the one more ordinarily adopted, and the one, as applied, with which we have at present to deal. This principle of manuring, then, is the returning to the soil, in an available state, those elements which have been eliminated by continued cropping ; and an enquiry into the nature of manures is evidently complementary to an examination into that of soils. In the preceding paper on soils, it was shortly stated how plants absorbed or took up from the soil certain elements which are always found to exist in the products of vegetation, and in what state of combination it was necessary that these elements should exist in order that they might be of value to the growing crop. It was also mentioned that different plants required different amounts of certain elements, and acquired the food necessary for their growth by dissimilar modes ; and more especially, it was stated, that continued cropping with one kind of plant deprived the soil of the particular substance which that plant required, and that the soil under such treatment became exhausted, or worn out, so far as that particular plant was concerned.

Before entering upon the subject of the principles of manuring, and the value of manures, it would be as well to look somewhat more deeply into the relation of plants to soils, in so far as the quantities of particular substances required by the former of the latter are concerned.

Plants are made up of two portions ; the one, on burning, disappearing in the gaseous form, is termed the organic portion ; the other, remaining as ash, being termed the inorganic portion. This latter amounts to from $1\frac{1}{4}$ per cent. to 4 per cent. in the seed, to 3 to 8 per cent. in other parts ; the great bulk of a plant is therefore made up of "organic" matter, the elements of which are to a very great extent absorbed from the

atmosphere. The inorganic portion seems to form, as it were, the framework of plants, and is therefore required in sufficient quantity to enable the individual plant to make a vigorous growth, so as to absorb through the increased area of its leaves the ever increasing quantities of the gaseous elements required in its development, which elements exist in abundance in the surrounding atmosphere. The whole of the inorganic portion of plants is necessarily taken up from the soil. Thus a favorable condition of soil causes powerful absorbent action by the leaves upon the required elements existing in the atmosphere, the ready supply here in its turn re-acting through the roots upon the soil; and where the latter also contains a ready supply of the necessary elements, this action and reaction proceeds at a rapidly increasing rate, and favorably, until the period of maturity of the plant.

When commenting upon the analyses of soils, it was shown that the bulk of all land is made up of sand, or clay, or lime, or in some instances of vegetable matter, colored more or less by iron oxides, the whole of these substances being usually present in abundance, though not required by the plant in its internal economy to any great extent; the substances phosphoric acid, potash, nitrogen, and silica in a soluble form, on the other hand, are required largely, and it is these very substances that are found to exist in but minute quantities in the soil, at least in an available form. Lime may almost, as far as Victorian soils have been examined, be included in this list, rather than in the former, for it is a necessity to plant growth, and is very deficient in all soils yet analysed.

According to Dr. Voelcker, the ashes of the following plants contain, in 100 parts :—

	Chlorine.	Potash.	Soda.	Lime.	Magnesia.	Ferric Oxide.	Silica.	Phosphoric Acid.	Sulphuric Acid.	Carbonic Acid.
Wheat	..	30·02	3·82	1·15	13·39	0·91	3·89	46·79	..	..
„ Straw	..	17·98	2·47	7·42	1·94	0·45	63·89	2·75	3·09	..
Oats	0·53	21·13	..	10·28	7·82	3·85	4·40	50·40	..	..
„ Straw	4·23	20·86	3·39	7·01	3·79	1·49	49·56	5·07	3·35	1·36
Barley	3·51	23·96	0·33	1·65	7·26	2·13	30 68	29·53	1·91	
„ Straw	1·43	11·22	0·71	5·79	2·70	1·36	68·50	7·20	1·09	..
Peas	2·74	43·61	0·41	4·78	5·78	0·18	0·68	36·50	4·47	0·82
„ Straw	..	21·30	4·22	37·17	7·17	1·07	3·23	4·65	8·68	12·48
Flax	0·24	34·17	0·12	8·40	13·11	0·50	1 45	38·54	1·56	0·22
„ Straw	6·14	21·53	3·07	21·20	4·20	5·58	7·92	7·53	3·39	15·75
Clover	8 55	30·14	2·01	21·57	8·47	1·26	1·95	4·09	2·96	18 05
Rye Grass	11·74	31·54	2·41	9·64	2·85	0 21	27·13	8 73	5·20	0·49
Turnip Bulb	4·25	23·70	17·55	11·82	3·28	0·47	2·69	9·31	16·13	10·74
Mangold	30·05	21·65	19·46	1·90	1·79	0·52	1·40	1·65	3·14	15·23

Average crops of these plants remove from the soil about the following quantities (in pounds weight) of mineral matters and nitrogen from

an acre of ground, estimating 20 bushels to be an average crop of wheat, and as a standard upon which to calculate the yields of the other crops :—

	Silica.	Potash.	Lime.	Chlorides.	Phosphoric Acid.	Sulphuric Acid.	Nitrogen.
Wheat	1·2	10·5	1·2	..	15·3	0·1	38·0
„ Straw	96·8	27·2	11·1	..	4·0	4·6	16·0
Oats	23·0	8·0	3·8	2·6	17·2	3·3	60·0
„ Straw	83·5	18·7	11·1	3·8	3·0	3·0	14·0
Barley	17·5	11·7	1·0	2·8	16·0	1·0	36·0
„ Straw	129·7	6·0	18·4	..	3·4	4·0	8·0
Peas	0·6	19 3	2·9	1·0	16·8	2·7	75·0
„ Straw	9·7	30·7	67·5	6·4	8·1	10·2	60·0
Flax	0·6	13·4	3·4	..	15·2	0·7	44·0
„ Straw	90·7	14·1	17·8	3·3*	15·4	4·0	16·0
Red Clover	10·0	44·0	103·0	16·0	18·0	12·0	74·0
Rye Grass	147·0	31·0	25·0	6·0	16·0	7·0	68·0
Turnip Bulb	4·0	112·0	32·0	26·0	32·0	40·0	76·0
„ Tops	..	50·0	70·0	25·0	11·0	29·0	50·0
Potato Tuber	2·0	87·0	2·0	9·0*	18·0	29·0	81·0
„ Tops	60·0	4·0	58·0	4·0	12·0	9·0	24·0

* Chlorine.

It is very evident, from a glance at the latter table, that, by cropping year after year with a certain species of plant, the time will come in every soil when the available quantity of some one element at least will become diminished to such an extent as to be insufficient for the profitable growth of that plant. The soil may still grow payable crops of a plant requiring different substances, but is infertile for the first ; and, in case that species only is required to be grown, the deficient substances must be applied or the land go out of cultivation. This application is what is known as manuring, and the deficient element may be supplied by using a manure containing it, amongst all the other matters required by plants ; by what is termed a general manure, or a natural manure, as it is formed from the waste or refuse of the plants themselves. Farm-yard manure is the most important of this class of manures. The deficient element itself may be applied, in which case it is termed a special manure, *i.e.*, a manure supplying a particular substance for a special purpose. These special manures can only aim at supplying the inorganic substances required, and are therefore also termed "mineral manures," and sometimes "chemical manures," from their being in general manufactured under the guidance of the agricultural chemist.

Special manures, then, afford a supply of the particular substances intended to be applied to a soil, and contain them in a proper state to be at once available. To successfully apply these it is necessary to

know, first, what substance is required in particular by a certain plant: thus—that for cereals, nitrogen is chiefly wanted; and for turnips, phosphoric acid. Secondly, the form in which the substances are taken up by the plant; and, lastly, whether the manure contains these substances in this state, as well as what quantity of such substance is actually present in any particular sample.

The first two questions, after long series of experiments, and after many years of investigation, are now allowed to be fairly answered, and therefore the only remaining necessity is the examination of the manures. This can only be done by exact and properly conducted chemical analysis, and by that alone. It is quite impossible for even the manufacturer himself to judge of the value of manures in any other manner.

Investigation has ascertained that the most important substances that may be beneficially applied to different crops, and the only ones that ordinary soils are likely to become deficient in, through abstraction by long continued cropping with one species of plant, are phosphoric acid and nitrogen, and also potash. Application of these substances, when properly made use of, never fails to show a good effect upon the crop, and we therefore possess the means, in average seasons, of regulating, to a very great extent, the yield of our soils; the only calculation to be made being the one of profit and loss, which must necessarily depend upon the market price both of manure and of grain, or of whatever other crop is raised. This question of profit and loss is one of great and increasing importance, for it is intimately related to that one which must be discussed in the immediate future, whether, when our virgin soils are used up, shall we import our breadstuffs, or can the once exhausted soils be made to yield profitable crops at a price not above that at which corn can be landed from foreign countries. The popular impression probably is that it would not be profitable to grow wheat, to receive for it say 5s. 6d. to 6s. per 60 lbs., with the aid of special manures on land once worn out. It is also very probable that the experiment has never been properly made, *i.e.*, that the experimenter has known what manure to apply, how and when to apply it, and also been really aware whether the manure he applied was actually what he deemed it to be. No doubt chemical manures have been applied, and are applied, and with varying results; but it appears very probable by the appearance of the manure market that the whole question is but little understood, and that with would-be improvers the application of manures is tentative rather than being a settled question, as far as ordinary crops are concerned, as it is on all leading points in older countries, the experience of which, on this point, seems to be thought

only of the same value as those farm practices which difference of climate, the value of labor, &c., render utterly impracticable in this country.

It having been ascertained that compounds of the three elements, nitrogen, phosphorus, and potassium, are alone those which it is found necessary to apply to a soil, the qestuion then arises—after having decided upon what crop to grow, and therefore knowing what element we wish to use—in what form shall the application be made? Bearing in mind that it is necessary to apply the element in a form in which it is soluble in water to be of immediate use, it is necessary to choose a manure containing the particular element combined as desired. The real value of manures of different sorts depends almost entirely upon this property; and in no class of manures is this difference of value so apparent as is those known generally as phosphatic manures.

Phosphatic manures, as offered in the market, take the shape of bone-dust of different sorts and qualities, superphosphate of lime, animal guano, phosphatic guano, &c., the mineral phosphates so much used in Europe not having been discovered here as yet. All these manures are of widely different values, though in some cases, perhaps, called by the same name. Samples of bone-dust vary greatly in value, still more do superphosphates and guanos. In Victoria this is especially the case with some classes of these manures, depending in the case of bone-dust upon the origin of the material supplied to the mill, whether the bones are clean or mixed with other animal matter, and also upon their treatment, whether boiled or steamed, and at what pressure of steam, &c., &c. In the case of superphosphates, this also depends upon what phosphate is used in the first instance, upon treatment during manufacture, and the amount of acid used in converting the insoluble phosphates into soluble phosphates, the high price of acid in Victoria compared with that in England rendering this more often a cause of the varying value of this manure. Guanos, too, differ widely in value, depending upon whether the island from which they are collected is favorably situated for their preservation or not.

Phosphoric acid should exist in manures in combination with some other substance with which it forms a salt soluble in water. Generally it exists in combination with lime, in form usually termed "bone-earth," from the bulk of the earthy material of bone consisting of this substance. This combination is, however, insoluble in water, and in that state is of no immediate value. Acids have the property, by depriving this compound of a portion of its lime, of causing the formation of another compound of lime and phosphoric acid, which is soluble, and

which may be recognised as the "soluble phosphate" in old analyses of superphosphate, and as monocalcic phosphate in those of the present day. Bone-dust as applied is of little immediate value for its phosphoric acid. As decomposition proceeds, however, acids act upon the insoluble phosphate, rendering gradually portions soluble, and thus bones act gradually. and during some time, depending, in the first instance, upon their condition, whether prone to decay readily or not. Assistance may be beneficially rendered to this process, especially by heaping the bones, and allowing them to heat.

The so-called "animal guano" is a phosphatic manure, made ordinarily from the refuse of meat-preserving manufactories, &c. ; it contains more fleshy and gelatinous matter than bone-dust, and therefore more nitrogen, and, if it has remained heaped any length of time, a small proportion of soluble phosphate is formed. In some cases sulphuric acid is used in the manufacture, when a more valuable manure results. The condition of the insoluble phosphates in these two classes of manures is most favorable for decay, being directly obtained from the bones of animals of recent existence ; but in phosphatic guanos this is not always the case, as in some instances, where the guano has been deposited on some coast in a more or less wet climate, and has remained for ages exposed to atmospheric action, the phosphates have become to some extent mineralized, and similar to the ordinary mineral phosphate. In this condition they are of no more value, as a manure, than sand ; it is, therefore, especially of importance, when purchasing a phosphatic guano, to be aware of the state of its phosphates.

The best mode of applying phosphatic manures is, undoubtedly, as soluble phosphate of lime—monocalcic phosphate. The manure known as superphosphate of lime is manufactured to that end, by the addition of sulphuric acid to bones, phosphatic guano, or mineral phosphate. The result is, as before-mentioned, the decomposition of the insoluble phosphate, the *tricalcic phosphate*, and formation of soluble or *monocalcic phosphate*, and *calcic sulphate* or gypsum, the latter being formed by the union of lime, withdrawn from the insoluble phosphate, with the added sulphuric acid. Lime is the oxide of the metal *calcium*, hence the use of words derived from the name of the metal, rather than the use of the word *lime*, in speaking of compounds of the metal with acids.

This soluble phosphate is immediately available for absorption by the roots of plants, and is really the only form in which phosphates should be applied, and is of the same value in all manures containing it, whether made from bones, phosphatic guano, or mineral phosphate.

Manures yielding nitrogen, also, differ widely, both in the quantity of nitrogen they contain and in the state of combination in which that element exists. Nitrogen is taken up by plants from the soil as nitric acid in combination with such bases as form with it soluble nitrates, which includes all likely to be found in manures ; and also as ammonia. Potassic nitrate (common nitre) and sodic nitrate (cubic nitre) are both very valuable manures for the purpose of furnishing nitrogen. But where nitrogen exist in such bodies as hair, wool, hoofs, &c., which, though rich in nitrogen, do not readily decompose, manures composed of these substances are of little present value. In such other animal matters as flesh, blood, &c., where the nitrogen exists as a component element of albumen and fibrin, and which bodies readily decompose, liberating the nitrogen either as ammonia or in combination with bases as nitrates, though the percentage of nitrogen is smaller than in hair or wool, still it is sooner available and the manure more valuable. In animal guano it is these albuminous substances that give excess of nitrogen over the amount found in bones, in which latter it is derived from the animal matter chiefly existing in the cancellated structure of the heads of the bones, the portion forming a joint with the next bone in the skeleton.

Ammonic sulphate and the best of the Peruvian guanos, however, are the manures richest in nitrogen. All guanos contain more or less, but it is only in the rainless regions of the Chilian coast that the compounds of nitrogen, originally deposited in the excreta of the sea birds, have remained to the present day ; in other cases a greater or less amount of rainfall having washed out a larger or smaller proportion.

These substances, then, supply the means of applying phosphoric acid and nitrogen, which are the two really costly substances that become deficient in soils. It remains to notice their actual and relative values in manures, and thus to ascertain their most profitable sources.

The value of a manure depends of course upon the nature and value of its constituents. Bearing in mind what has been said as to the value of particular substances to certain crops, it will be seen that, though certain substances have a regular market value, this value is no criterion as to the value of any one manure for any particular crop. For instance, if bone-dust be worth in the market £6 10s. per ton, it would not be worth anything like that sum if bought for application to a wheat crop, for its chief constituent—the phosphates—would be of little value to the wheat ; the value of the manure in this case depending almost entirely upon the amount of nitrogen it might contain. Therefore it must be understood that, in giving a standard of value for manures, it is only a market standard, the whole question of the application of the

proper substances would still remain to be decided, though, when this point is settled, and with a knowledge of the composition of manures through chemical analysis, and ability to value them exactly, it is easy to decide upon which manure would be most suitable to the case in point, *i.e.*, in which would the substances it is desired to apply be purchasable at the lowest price.

The bulk of the manures offered to the agricultural public in Victoria have bone material for their foundation; they are phosphatic manures. Their value, as has been stated, depends entirely upon the quantities they contain of—

1st. Soluble phosphates. | 2nd. Insoluble phosphates.
3rd. Nitrogen.

These constituents are valued in England as follows:—Soluble phosphate, £24 per ton; insoluble phosphate, £8 per ton; and nitrogen, £72 per ton. Prices in Victoria may be higher somewhat, though not in the case of insoluble phosphates, as bone-dust is shipped to London amongst other places.

These prices, however, depend entirely upon those at which these different substances can be procured in the market in other forms. American prices differ considerably from those quoted as English, and a good American authority values phosphoric acid in soluble phosphates at £56 per ton; in insoluble phosphates, £21 per ton; nitrogen in bones, £79 10s. per ton. Soluble phosphate would at this valuation be worth £34 per ton, and insoluble phosphate £9 10s.; though when the latter exists in fine-ground steamed bones it is more valuable—to the extent of say 30s. to £2 per ton—than that contained in unsteamed, coarse broken bones, on account of its becoming more quickly soluble after application.

The following are results of analysis of two samples of bone-dust manufactured in Melbourne, and largely exported:—

In 100 parts.	Sample No. 1.	Sample No. 2.
Water	6·762	5·222
Organic matter*	34·143	30·244
Tricalcic phosphate (bone earth)	44·144	48·423
Calcic carbonate	7·175	10·664
Sand	6·034	3·326
Alkalies	1·742	2·121
	100·000	100·000
* Containing nitrogen	3·536	3·619

These are both good samples of ground bones, and, at the prices given above, are fully worth the price usually quoted for bone-dust in Melbourne, viz., about £6 10s. per ton. These two samples would be worth—

		At English Values.	At American Values.
No. 1.		£	£
Tricalcic phosphate	44·144	= 3·53	= 4·19
Nitrogen	3·536	= 2·54	= 2·81
Organic matter	34·143	= ·36	= 0·36
Alkalies	1·742		
		6·43	7·36
Per ton ...		£6 8s. 7d.	£7 7s. 2d.
No. 2.			
Tricalcic phosphate	48·423	= 3·87	= 4·60
Nitrogen	3·619	= 2·61	= 2·88
Organic matter	30·244	= ·32	= 0·32
Alkalies	2·121		
		6·80	7·80
Per ton ...		£6 16s.	£7 16s.

The manures termed animal guano have not been sufficiently examined to warrant expression of opinion generally. The name not expressing any definite article, there is doubtless great diversity in the manures classed under this head. One sample, analysis of which is given below, appears to be merely refuse from meat preserving companies' works dried and ground. It is a very useful manure, though not equal to the two samples of bone-dust, the excess of water and amount of earthy impurities being the cause of its somewhat inferior value. Possibly the amount of sand, &c., in this sample may be unusual, as there is no reason why a manure of such origin should be so contaminated.

Analysis of Animal Guano

	100 parts contain
Water	11·874
Organic matter*	29·926
Tricalcic phosphate	34·277
Calcic carbonate	8·027
Sand	14·623
Alkalies	1·273
	100·000

* Containing nitrogen, 2·932

The value of this manure would be—

——		At per Ton.	At English Values.	At per Ton.	At American Values.
		£	£	£ s.	£
Tricalcic phosphate ...	34·277	8	= 2·740	9 10	= 3·256
Nitrogen	2·982	72	= 2·147	79 10	= 2·353
Organic matters ...	29·926	...	= ·299	...	= ·299
Alkalies	1·273	...	= ·013	...	= ·013
			5·199		5·921
Or, per ton ...		...	£5 4s.	...	£5 18s. 6d.

A second sample, also termed "animal guano," when examined gave results so similar to those of analysis of a sample labelled superphosphate of lime, that they must be considered one substance, though differing somewhat in colour.

The following are the results of analysis:—

——	Animal Guano.	Superphosphate.
	100 parts contain	100 parts contain
Water	7·977	8·014
Organic matter	46·765	48·585
Monocalcic phosphate	2·219	2·060
Tricalcic phosphate	23·736	22·000
Calcic sulphate	11·674	11·689
Sand	4·723	4·130
Alkalies	2·906	3·522
	100·000	100·000—
Total sulphuric acid	7·74	7·86

It is evident, from a comparison of results of two samples of animal guano, that analysis alone will give the real value of the manure.

No good sample of superphosphate of lime has as yet come under notice. As this manure varies so much in composition, every purchase made, where the quantity is more than even 5 tons, should be examined to ascertain the amount of phosphates and nitrogen. The following is the result of analysis of a superphosphate of local manufacture, and is given to show its value by price test, and not as a sample of the ordinary

article found in Melbourne, which will on examination yield probably much better average results :—

ANALYSIS OF SUPERPHOSPHATE OF LIME.

	100 parts contain
Water	16·00
Organic matter*	27·51
Monocalcic phosphate	4·66
Tricalcic phosphate	26·12
Calcic sulphate	18·24
Sand	4·12
Alkalies	3·35
	100·00
Total sulphuric acid	14·11

* Containing nitrogen, 2·537

Applying price tests, its value is—

		At English Values.	At American Values.
		£	£
Monocalcic phosphate	4·66	1·12	1·58
Tricalcic phosphate	26·12	2·09	2·48
Nitrogen	2·537	1·83	2·02
Calcic sulphate	18·24	0·51	0·51
Organic matter	27·51		
Alkalies	3·35		
		5·55	6·59
Or, per ton ...		£5 11s.	£6 11s. 9d.

An ordinary sample of English make, worth in the London market about £6 5s. per ton, would contain on an average—

Monocalcic phosphate... ...	20	at £·24 =	£4·80
Tricalcic phosphate	12	at ·8 =	·96
Nitrogen	1	at ·72 =	·72
			£6·48

Or £6 9s. 7d. per ton.

The following analysis from Professor Caldwell's work, as giving the composition of an American sample, is inserted also for the sake of comparison :—

	Per cent.		Dollars.
Phosphoric acid in soluble phosphates	11·7	at 12½ cents per lb.	= 1·46
Ditto, in insoluble phosphates ...	2·19	7½ „ „	= ·32
Nitrogen	·41	19¼ „ „	= ·08
			1·86

Or, per ton of 2000 lbs., 37·20 dollars = about £8 per ton of 2240 lbs.
11·7 phosphoric acid = 19·28 monocalcic phosphate.

Comparing these samples with Victorian, both as given above and those published by Melbourne manufacturers, it will be seen that the local samples contain more nitrogen but less soluble phosphate. This is due to the nature of the basis of the manure, which is here bones, and in Europe more often mineral phosphate. The latter contains no nitrogen; and what is contained, in samples made chiefly from this mineral phosphate, is derived from the amount of bone-dust which is usually added, to take up the excess of sulphuric acid used in converting as much as possible of the useless mineral tricalcic phosphate into monocalcic phosphate. The excess of soluble phosphate in English superphosphates is probably chiefly due to the difference in price of sulphuric acid here and in Europe. The higher price here will probably not continue as demand increases; but, at present even, it may be well for manufacturers to bear in mind that, if soluble phosphate be required, a few hundred pounds weight of acid will make all the difference, when applied to a sample of bone dust or other phosphatic substance containing as much as 6 to 10 per cent. calcic carbonate.

Eight per cent. of calcic carbonate will require, for its conversion into calcic sulphate, about 300 lbs. of sulphuric acid of 1·50 specific gravity per ton of material, before the tricalcic phosphate is acted upon. Therefore, in such manures as those two samples examined, containing 7·74 and 7·86 per cent. sulphuric acid, which is equal to about 350 lbs. of acid, specific gravity 1·5 per ton, 300 lbs. of this acid will have gone to convert calcic carbonate—estimated at 8 per cent. in original material with calcic sulphate—the remaining 50 lbs. only going towards converting tricalcic phosphate into monocalcic phosphate. In this instance calculation gives 1·64 per cent. as the amount of monocalcic phosphate which should result, supposing the amount of calcic carbonate to be just 8 per cent. and to be all acted upon. As there is, also, always a waste of acid which remains nearly the same, whether a larger or smaller amount is used, it is evident that, after the whole of the calcic carbonate is converted, every 100 lbs. of acid added to a ton of phosphatic substance would increase greatly the comparative percentage of the soluble phosphate. Thus, if 300 lbs. of acid, of 1·50 specific gravity, be required to convert the 8 per cent. calcic carbonate supposed to exist in the substance to be made into a superphosphate, and if only 300 lbs. be added per ton, what soluble phosphate may result will be only accidental, and there will still be calcic carbonate existing. If 450 lbs. be used, there should result—in theory—about 4¾ per cent. soluble phosphate, or but little more than 1 per cent. per 100 lbs. of acid; but if 600 lbs. be

used, the extra 150 lbs. of acid will increase the amount of soluble phosphate to over 9½ per cent.; whilst a total of 900 lbs. acid per ton should make the percentage of soluble phosphate 19½ per cent., or over 2 per cent. per 100 lbs. acid. That these figures are not quite borne out in practice does not alter the fact that every 100 lbs. of acid added, after the conversion of calcic carbonate, creates soluble phosphate at a lower rate per unit of percentage, and is therefore cheaper to manufacture. In cases where superphosphates only contain 3 or 4 per cent. of soluble phosphate, the great bulk of the acid has been, one might almost say, wasted. The monetary results are easy of calculation, thus—

		Per cent.		Per unit.
450 lbs. acid, costing	£1 12s., would give	4¾	soluble phospate	= 6s. 9d.
600 lbs. „	£2 2s., „	9½	„	= 4s. 5d.
900 lbs. „	£3 3s., „	19½	„	= 3s. 3d.

The results in the manures would be for the consumption of—

		Per cent.			At English prices, £24 per ton.	At American prices £34 per ton.
450 lbs. acid, cost	32s.,	4¾	soluble phosphate,	worth	£1 2 9	£1 12 3
600 lbs. „	42s.,	9½	„	„	2 5 6	3 4 6
900 lbs. „	63s.,	19½	„	„	4 13 7	6 12 7

It is evident that it cannot pay the manufacturer to make a poor superphosphate to receive even the high American value for soluble phosphate.

The above figures are approximate merely. For instance, sulphuric acid of 1·50 specific gravity is assumed to contain 50 per cent. of anhydrous acid—there is also always a margin between theory and practice—but they are near enough to the truth to illustrate the point intended to be noticed.

The last phosphatic manure examined is an imported one—a guano. This is used to some extent for the basis of superphosphate, for which purpose it is well adapted.

The following is the analysis:—

	100 parts contain
Water	8·885
Organic matter*	16·122
Tricalcic phosphate	65·070
Calcic carbonate Calcic sulphate }	8·901
Silica	·518
Alkalies	·504
	100·000

* Containing nitrogen, 1·361.

A sample called guano superphosphate gave the following results on analysis :—

	In 100 parts
Water	10·200
Organic matter *	16·119
Monocalcic phosphate	·987
Tricalcic phosphate	64·168
Calcic carbonate	6·976
Calcic sulphate	·712
Silica	·358
Alkalies	·480
	100·000
Total sulphuric acid	·810

* Containing nitrogen, 1·389

These two samples are evidently the same substance, although called by different names. They are both samples of a first class phosphatic guano, and on applying the price test their value is found to be about £6 10s. per ton at English prices, to about £7 10s. at American. The foregoing analyses and description will only give an idea of the class of manures chiefly manufactured at present in Victoria and of their values. The total quantity manufactured is large, but the bulk, instead of being consumed in the country, is exported for the supply of foreign markets. The cause of this is probably a disputed question, but must be looked for in one or more of the following directions. Either the land of Victoria, taken as a whole, is not yet sufficiently worn out to make the use of manures general—the manures themselves do not contain the constituents mostly required by farmers ; or, the price may be too high to make their application profitable ; or, possibly, much misconception prevails upon the subject of the use of special manures. Probably the cause may be deduced from the whole of these suggested reasons. Thus, for land growing wheat and grass, the proper application is a nitrogenous manure. The manures manufactured are phosphatic, and do not contain sufficient nitrogen for this purpose, and are, in consequence, too expensive for application to such crops for the nitrogen they contain. Therefore it is possible that through inexperience these manures have been often applied to grain crops with but poor results. So the three last reasons follow one another in a natural sequence. In this case the local demand would be, and should be, more from market gardeners than from farmers proper, in the absence of the root crop as a leading feature in farm practice. Thus, a

valuable fertiliser like bone-earth is exported to improve the condition of sugar and coffee plantations, or root crops, in foreign countries ; and Victoria has to submit to the yearly drain. A few figures will illustrate the extent of this drain of the phosphates.

For 1872 the Custom House returns show an export of over 3000 tons of locally manufactured bone-dust and animal guano. For twelve months of 1873–4, one company alone—the Australasian Bone Mill Company—return an export of 4500 tons ; or, excluding imported and treated guano, of 4100 tons locally manufactured.

Returns were asked for from others of the principal exporters ; and in their absence, and as a basis for calculation, suppose that they exported *only* an equal quantity. This would make the export for the last twelve months over 8000 tons. The export of breadstuffs from South Australia seems an immense drain upon the resources of her cultivated lands ; but as far as the substance known as bone-earth is concerned, the export of Victoria of that substance, for the last season, contained in manures of local production, was in amount more than five times the quantity contained in the 47,000 tons of wheat and flour exported by South Australia during the same period. It is true the amount of nitrogen in that quantity of wheat is in excess of the quantity exported from Victoria in these manures, but that does not alter the fact of the large export of a most valuable constituent of all products of cultivation.

The names of the places to which these 4100 tons were exported by the company above mentioned are somewhat suggestive, and include Mauritius, Ceylon, Tasmania, Java, England, Natal, China, India, and New Zealand. Mauritius, Ceylon, and Tasmania head the list with 1500, 1300, and 800 tons respectively.

Nitrogenous manures—those containing nitrogen as their chief constituent—have not yet come under notice to any extent, the short time at disposal only having permitted of the partial examination of phosphatic manures. It will be perhaps as well to mention that the chief of these manures are the ammoniacal (Peruvian) guanos, "nitrate of soda," and "sulphate of ammonia ;" to which it is to be hoped will be added in next year's report locally manufactured manures, as poudrette, and manures made from blood and other refuse matters. In all these nitrogenous manures—which are those of the greatest value for application to land growing grain crops or grasses—the same method of calculation of values is adopted. As has been before stated, nitrogen in some states of combination is of more value than in others. In manures containing it as ammonia, or as a nitrate, it is more valuable than when existing in bone ; and in good bone-dust it is of more value than in hair, wool, &c.

This must be borne in mind when calculating values. One good authority gives the relative value of nitrogen in the three substances mentioned as about 11 : $8\frac{1}{2}$: 7.

The amount of nitrogen in good Peruvian guano should be about 16 p.c. Good commercial samples of "nitrate of soda" contain from 6 to 8 per cent. of impurities, the 92 to 94 per cent. of nitrate yielding about $15\frac{1}{2}$ per cent. nitrogen. "Sulphate of ammonia" contains 19 to 20 per cent. If the quantities therefore of nitrogen in these substances are known, it is easy to decide as to which is the cheapest to purchase for its nitrogen, at the market price of the manure. The quantity of nitrogen in any one of them can only be known by chemical analysis, as adulteration of all of them is a very simple matter.

There are many refuse substances existing which are likely to prove of use as manures, an inquiry into the value of which has not yet been undertaken at this early period of the existence of the laboratory ; but such an inquiry is evidently one likely to prove of value, and will be carried on, together with other inquiries concerning manurial substances, as opportunity offers.

I have, &c.,

W. E. IVEY,

Chemist, Department of Agriculture.

A. R. Wallis, Esq.,
Secretary for Agriculture.

REPORT UPON THE VICTORIA, DANDENONG, AND BULLAROOK STATE FORESTS.

SIR,

I have the honor to submit the following Report upon the Victoria, Dandenong, and Bullarook State Forests. The existing state of these forests with respect to the timber supply, to the prospects of the natural renewal of the trees upon those portions which have been denuded of their timber, and to the practices of the people engaged in felling, have been alone enlarged upon; a few descriptive notes being here and there added where they appeared to be of interest and value. The question of management has not been touched upon, beyond perhaps the suggesting of the adoption of some improvement which seemed palpably to offer itself as requiring attention.

THE VICTORIA FOREST.

This State forest reserve is almost conterminous in its boundaries with a patch of volcanic rock forming a portion of the ranges in which the River Yarra Yarra takes its rise; which river, with its tributary the Armstrong Creek, forms the forest boundary to the south and east; the other enclosing lines, at present unsurveyed, being drawn between such well-known land-marks as Mount St. Leonard, Mount Arnold, &c., and in conformity with the physical features of the country, so as to include, as nearly as possible, the whole of the most heavily timbered country upon this portion of the ranges.

Geologically, the formation is of the older volcanic period. The rock is a felspar porphyry, varying in its constitution considerably in different places—as is so often the case with these rocks—breaking up, also, into soils of greater or less depth and value, as that portion of the rock from which they are derived has been able more or less successfully to resist the disintegrating effects of atmospheric action.

The higher portions of the ranges apparently yield most readily to these influences, and in nearly all cases are covered to a considerable depth with a soil which, judging from the stupendous tree-growth found on these summits, and from its appearance when mixed, as it is here

almost to excess, with the organic matter derived from the natural decay of vegetation for a long series of ages, is one of great richness. At lower levels the depth of this dark-brown mould is less—except where accumulated *débris* is found in the small gullies—and the peculiar red soil formed by the older volcanic rocks on their decomposition, and here existing to the depth of several feet lying upon the rock itself, is easily laid bare. This characteristic red subsoil is to be found over the greatest portion of the area of the forest; the chief exceptions being the spurs of lower elevation—as, for instance, between Healesville and Fernshawe, where the rock disintegrates into a poor sandy loam, and that portion to the north-east beyond Mount Arnold, where the silurian schists abut on the volcanic rock, again giving rise to a poorer soil though still one yielding good timber—together with such small alluvial flats as may be found along the course of the larger streams, as the Watts.

Physically, almost the entire area may be said to consist of one main range, with its subsidiary spurs, Mount Juliet being the only independent height of any importance. These spurs are numerous, and the intervening gullies steep and of great depth. The bottom of each forms the bed of a stream of water, of larger or smaller dimensions, which flows to the Yarra or the Goulburn, according as its course lies north or south of the main range, that here divides the watershed of these rivers. The country may be described as very broken and rough, and is, except where tracks have been cut, most difficult to traverse. With the exception of the main road to Marysville—and perhaps of the old road through Paradise Plains, which though is now so overgrown with underwood and blocked up by fallen trees as to be almost obliterated—there are no roads but such as have been made by splitters and others for the purpose of drawing out timber. These exist but as tributaries to the main road, and run from it but a short distance, three to four miles being the utmost length of any of these tracks. In that portion of the forest about the head waters of the Watts River, and between Mount Juliet and the Cumberland Creek, which is distant from the main road, there are no tracks whatever; the country is covered with almost impenetrable scrub, and is but little known until the schistose rocks are reached, where the gold-digger has, to a small extent, explored the depths of this almost unknown region.

The features of the vegetation which clothes this part of Victoria are as well marked as those of the rocks: the area occupied by certain species of the prevailing trees being almost conterminous with the particular rock which that species would seem to affect. The great

extent of the soil of the forest—all that is of porphyritic origin—is covered with that species of eucalyptus known locally as the mountain ash, but more generally identified as Eucalyptus amygdalina. These trees grow in the greatest perfection from the very highest parts of the ranges—excepting the summits of such mountain peaks as Juliet—down all the more rugged spurs and gullies, the trees at the highest elevation vieing in size with their apparently more favorably situated neighbors in the gullies. The undergrowth in these parts consists, in the gullies, of sassafras, the Australian beech, musk, and blackwood, with tree-ferns, all in great abundance, and, on the spurs, of a mass of shrubs forming, with the wire grass, in many places, a scrub of the densest character. At a lower elevation, upon alluvial flats, and along the course of creeks, the whitegum is found, a tree in many places merging, to all appearance, into E. amygdalina; whilst on the poorer soils of the lower spurs, the messmate, which exists to some extent on the higher ranges as fine individual trees, appears in greater numbers, giving place on the worst portions of the land to stringybark, peppermint, and box—different species of acacia prevailing as undergrowth, in the place of those plants which are almost peculiar to the better soil of the higher elevations.

This alternation of rugged hill and gully, clothed with a magnificent growth of enormous eucalypti and varying undergrowth—the tangled mass of the numerous species of shrubby plants on the spurs yielding in the valleys to the sassafras, beech, &c., with, in many places, large masses of the arborescent fern—extends from the township of Fernshawe along the main road as far as Mount Arnold, and from Mount Leonard to the Black Spur, and again from Mount Juliet, through all the country examined, to Mount Strickland and towards the Cumberland Creek, where the change of formation to the silurian takes place. The whole extent of this portion of the forest is at once recognised as similar throughout, by the prevalence of E. amygdalina, which might be termed its distinguishing botanical feature. This tree is found in great perfection over the most part of this area; a diameter—at the butt—of from 5 to 8 feet being the ordinary size attained. Trees of these dimensions grow wonderfully close together, whilst bolls 12 to 15 feet in diameter may be found readily enough in many places, and some of still larger diameter require only a little search for discovery. The height reached by the larger trees is ordinarily about 320 feet. Trees 350 feet, and even 380 feet in height have, however, been measured, the latter being exceptional. The barrel of these trees is straight and branchless even to 200 feet. The grain of the wood is

straight, splitting easily into thin portions suitable for palings and shingles, which causes them to be sought after for these purposes chiefly. The wood, unless well seasoned before being sawn, is soft and apt to decay, its term of existence, when thus sawn from a newly-felled tree, being only four or five years.

There is no part of the forest that appears to suffer, to any serious extent, from a deficiency of mature timber, Mount Strickland and the ranges near at hand, where fire has committed great havoc, being the exception. Timber cutters, though doing immense damage in proportion to their numbers, are happily not numerous enough to have as yet made any very serious inroads, comparatively, upon the supply existing in this fine timber reserve. Along the course of the stream, known locally as Contentment Creek, a tributary of the Watts River rising to the north-east of Mount Monda, the timber has been much thinned, all the straight-barrelled trees having been felled ; but beyond the existing track, and up to the very summit of Mount Monda, splendid specimens of the eucalyptus grow in abundance, the country being too rugged for the splitter, whilst so much timber, more easily got at, is available. Eastward from Monda traces of the splitter are absent till a point is reached about halfway to the Marysville road over the Black Spur. From this point a splitters' track leads into that road, and the straightest trees have been felled on both sides of this track along its whole length. Again, up Morley's Creek, towards Mount Dom-dom, the splitter has been active ; also in the upper portion of the Watts Valley, and again northward, between the Mount Strickland Range and the Sugarloaf. At the foot of Mount Juliet, at the head waters of the Graceburn too, his presence is very evident from the remains of noble trees left to waste.

On the north side of the range less splitting has been carried on, probably only for the supply of local wants and the demand from the Alexandra district. Mount Bismarck exhibits some traces of paling splitting, as do also parts of the forest about the Cumberland Creek and Mount Arnold, but to no great extent. Along the main road, about this point, just before, or about where, the volcanic rocks give place to the silurian, as good a view of the class of timber that is gradually disappearing before the splitter may be easily obtained as could be had by traversing any part of the forest. It is fortunate the splitter is not strong numerically, the number at present finding occupation in the whole forest only being about eight, though a view of the immense amount of *débris* around their haunts would lead one to estimate their number at some high multiple of eight, or, on the other hand, to form at first sight an exalted opinion either of their industry or of their destructive powers.

The nature of this *débris* at once attracts attention to the practices of these splitters. It seems to be the custom for each one splitter, or pair of splitters, to work in a separate part of the forest; hence the work of these men for years past may be observed in their respective favorite gullies. It is only necessary then to take notice of the number of felled trees in any one of these gullies, and to observe the quantity of each tree made use of, in order to arrive at a fair estimate of the proportion of timber utilized to that left to waste; for as there are no sawmills to use up trees felled and rejected by splitters, all are left to decay that do not satisfy the epicurean tastes of these men.

The choice of trees is so great in this forest that only those best suited for splitting are used up after they are felled. If when a tree be cut it does not split very true, the palings requiring but little after trimming—if the wood be "pipey," *i.e.*, has along the flat side of the paling slight ridges about the size of a pipe stem, thus also requiring a little more trimming—or if parts have on one side knots or injuries which would entail extra labor, or interfere with the easy splitting of that particular "cut"—a "cut" being a section of the butt 5 or 6 feet in length, according to the length of paling required—either the whole tree, or a greater or less portion of it is rejected and left to decay, the felling of a more promising-looking tree, or even two, entailing somewhat less labor than would be expended in getting the palings out of a felled tree slightly more difficult to split. As there is endless choice, and trees the growth of centuries, hardly to be matched elsewhere, are plentiful, are the property of the State, and cost nothing, this practice obtains, and the result is to be witnessed in the vast number of the finest trees of the forest lying rotting upon the ground. In some instances not a paling has been taken from a tree which could hardly be matched out of this forest, in many others a single "cut" only has been taken, and it is only in rare cases that the whole butt has been used up; and then, as these trees are of large size and the straight barrel only is used for splitting, the top, which hardly ever measures less than 24 inches in diameter at its lower end, and would be considered a large tree in very many other parts of the country, is left to waste. A liberal estimate of the ratio which the timber used bears to that wasted, calculated from the barrels alone, gave the proportion of about 1 to 8. Trees that would each cut many thousands of feet of sawn timber lie about in numbers, and it is painfully evident that reckless destruction of a valuable asset of the country is taking place which would not have been perpetrated for the sake of a few palings—the greater part of the cost of which to the consumer is made up of carriage—if the men were forced to pay for

each tree they felled. There would then be some check upon the enormous waste, and the indiscriminate destruction of the largest timber trees in Victoria—which trees, once cut, will naturally require centuries to replace—and the selfish indifference to the wants of future generations displayed by timber cutters would not be exhibited as at present. Timber trees would be economically utilized, or, if extra cost of trees added to cost of carriage, &c., forbade continuance of work in this forest, those employed therein would occupy themselves with more profit to the community in general by following other avocations than by destroying, for a pitiful wage, what should be preserved as the inheritance of future generations.

The smaller timber consists of beech, blackwood, and sassafras, chiefly in patches in the gullies and at the head of the smaller creeks. Some of these patches are of considerable size, and on the whole there must be a large quantity of beech and sassafras, though in no one spot could the number of trees be termed a forest. The gullies at the higher elevations are mostly clothed with these trees; the Myrtle and Cumberland Creeks, and the head waters of the Watts River, being the places where they are to be found in the greatest perfection, the beech more especially. This tree has not been cut to any extent, though the wood seems well adapted for cabinetmakers' work, and trees from 12 inches to 3 feet, and even 4 feet in diameter, exist in several places in sufficient numbers to seem well worthy the attention of persons engaged in trades requiring a supply of ornamental woods.

The sassafras, on the other hand, has had a raid made upon it by persons who supply the makers of "shoemakers' lasts," and who, to obtain the wood free from knots, which it appears is a necessity in wood used in this trade, commit great havoc and waste amongst these handsome trees. This cutting has, however, been stopped in this forest, and in time to save the great bulk of this species of the smaller timber trees.

The blackwood has also been cut into where approachable, as along the Contentment Creek and elsewhere. Much is, however, left throughout the forest, though there is not so great a quantity of this timber as of those above mentioned. The chief use to which it is put is the manufacture of staves for casks. The musk is abundant everywhere; and there are several other trees and shrubs of minor importance, which exist in quantity, and which may, some of them, require more than mere mention at some future period.

The denudation of this forest being so partial, but a few words are necessary with respect to the restoration thereof. As already stated,

though the destruction of timber by each individual employed in the forest is very great, their numbers have not sufficed to denude any large area. As they have only felled the largest trees, they have but thinned out certain places, and not sufficient clearance has been made in any one place to enable one to ascertain by inspection what efforts nature would be likely to put forth in renewal of the expended timber, were the whole of the trees to be felled. As far as can be seen, however, sufficient young trees are growing up to take the place of those used; and, reasoning by analogy, from the thick growth of young trees that elsewhere upon these volcanic soils spring up after total destruction by fire of the matured trees, there should be but little doubt of the same result following here, were all the standing timber removed and a fair start given the young seedlings which appear. Unless in very hot seasons there is not so much risk from fire in this forest as elsewhere, in consequence of its elevation above the sea-level, and the dense nature of the vegetation not allowing everything to be readily dried up by the sun's rays. As fire, however, is the greatest enemy to be feared in all Australian forests, all possible precautions should be taken to prevent its occurrence.

The distance from market and absence of communication by rail have, up to the present time, deterred sawmillers from erecting machinery in this forest. In time, doubtless, this state of things will be changed, and, with a view to this probability, the conformation of this country should be observed and noted before any license for any particular portion be issued to any millowner, especially if regulations as to exclusive right to cut be issued.

From the conformation of the ranges, there are but two or three main outlets to a large extent of country, and it would be quite possible for a licensee, by building a tramway or otherwise, to monopolise a very large extent of forest. On the other hand, by preserving to the general public the main outlets, and licensing the erection of trams only up the subsidiary valleys, no part of the country could be more easily parcelled off into distinct areas, if desired.

The Dandenong Forest.

This forest is very similar in its surface conformation to the Victoria Forest, and presents many points of interest of a like character. It is situated upon rocks of the same age, forming on disintegration the same peculiar red subsoil, and the same rich brown loam on admixture with decaying organic matter at the surface. This loam extends over all the

higher ranges, and is richest at their extreme points, a feature likewise noticeable in the Victoria Forest, and due probably in both cases to the rock at the higher elevations being more easily decomposed. The only spots of apparently equal quality to these are certain small alluvial flats in the gullies, where much vegetable *débris* has been added to the wash from the hills. Other points of similarity in the two forests may be noted in the difference in the quality of the soils of the lower spurs, the transition from the richer to the poorer being sudden and clearly marked. But the similar character of the vegetation is even more striking than that of the soils which support it. The Dandenong Range, in fact, appears to have been called into existence by the same action that raised those more important ones at the head waters of the Yarra, and of which it seems to be an isolated offshoot.

In its general conformation the country at Dandenong may be said to consist of a main range, and running in a north and south direction from the Trig. Station to One-tree Hill, and two ranges running from this nearly at right angles to the eastward, their elevation becoming less as the distance from the north and south range increases, until they merge into the upper silurian schists about the eastern boundary of the forest. These main ranges throughout their whole length are covered with the better class of soils, and as might be anticipated by any one familiar with these elevated volcanic regions, the E. amygdalina is the prevailing tree, and in the richest spots it, with the whitegum and messmate, vies in size with the magnificent specimens of timber trees to be found in the sister forest.

The change to the lower spurs and poorer soil is at once observed in the altered character of the vegetation, both trees and undergrowth. The E. amygdalina wholly disappears; the messmate increases numerically, but is individually smaller; stringybark, peppermint, and box take the place of the messmate as the soil becomes still poorer, becoming themselves at length stunted and useless for all purposes but firewood.

The chief points of difference between the two forests and those worthy of noting here are—

1st. The extent to which the timber has been consumed; the effects of cutting and of fire in destroying the formerly existent supply; and the quantity of timber at present available.

2nd. The amount of cutting at present going on, and the probabilities of its increase or otherwise.

3rd. The result of nature's efforts and powers of recuperation in renewal of expended trees.

4th. The probable expediency of aiding the natural process of renewal where no young trees appear to be taking the place of the old ones; and

5th. The relation of selected lands to the State forests with regard to the shutting up of the natural lines of egress and ingress, by alienating the old tracks.

Throughout the Dandenong Forest, it is evident that wherever good timber was easy of access it has been cut, and wherever a dray track could be made the best trees on both sides of its course have been removed. Thus it is only where approach is difficult that the forest can be seen in its natural state. Upon the range at the head of the Fern-tree Gully, of which the One-tree Hill forms a part, the existing timber is but of moderate size, and the trees do not stand thickly together, evidently having been thinned. Along the range to the eastward the individual trees are larger, and there are still to be found some really fine specimens of the E. amygdalina, the whitegum, and the messmate. Along the south side of the southern range, to the west of the north and south range, and to the northward of the northern range, dray tracks penetrate to greater or less distances, and along these the condition of the forest is similar in all parts: the best trees have been weeded out. But it is fire that has caused the greatest havoc on these ranges; and the damage is greater than at first sight would appear, for the rapid growth of young saplings to a great extent hides from casual notice the fact that most of the best trees over large areas have been destroyed. The growth of these saplings is very quick, and they will in time furnish a good supply of timber, but they cannot be counted upon for present wants. It is then only where neither fire nor the splitter has been enabled to approach that any country exists that could be pronounced to be heavily timbered. Such spots, however, do still exist to some considerable extent, and contain a fair amount of timber, though the quantity is small when compared with the areas of equal quality in the Victoria Forest. Of second-class timber there is yet comparatively a good supply, taking into consideration the area of the forest, which, at the present rate of consumption, will supply all demands for a long time to come.

It is true that at present these demands are not large, owing probably to the difficulty of reaching the remaining E. amygdalina, which tree alone is used for paling splitting. The fact that it requires a team of eight bullocks to draw out a load of 300 or 400 palings is sufficient to explain the almost entire cessation of this industry. The splitting of posts and rails, too, is not carried on to any extent, the demand having

diminished to its present rate in consequence of the fencing of most of the local agricultural lands having been completed. The demand from Melbourne for both posts and rails and palings is chiefly supplied from other districts. Firewood, also, is procured for the metropolis from private lands nearer town. The demand for sawn timber also is not met in any degree from Dandenong, nor does there seem any immediate prospect of any of these industries being revived. The amount of first-class timber accessible is not sufficient to offer inducements to sawmillers, and improved communication between the central portions of the forest and its outskirts, and with Melbourne markets, appears to be necessary before any large amount of work would be carried on by the other classes of men finding occupation on the forest lands of the country.

The renewal of the consumed trees by the hand of nature seems to be sure, under certain conditions. The great fire of 1851 cleared large areas of every kind of vegetation. These are now covered with a thick growth of fine young trees from 80 to 100 feet in height. The only fault that can be found with nature's handiwork in this case is the fact of the young trees growing much too thickly to render it probable that, without thinning, trees such as preceded them will be produced. Very different to this exuberant growth is the appearance of those parts of the forest thinned by the hand of man. Here seedlings do not, as a rule, take the place of the felled trees; but the forest in these places is left open, with an appearance of bareness.

It is such places as these that suggest the expediency of assisting nature's efforts to renew the original tree-growth, or to attempt improvement of the forest production by the substitution of improved species of trees. There are several spots in this forest that require attention, and some that offer special facilities for the experimental raising of trees of other than the prevailing species. Some such spots on the higher ranges seem favorable to the trial of the best species of the eucalyptus, which are suited to elevated volcanic regions, as, for instance, the Tasmanian bluegum. These spots would, however, be more or less subject to damage from bush-fires, and expense would be necessarily incurred in the first instance in burning off the vegetation now covering them, and in afterwards preventing its growth over any considerable area in any one spot, so as to keep any accidental fire within bounds. It would be sufficient, beyond this, merely to sow the seed on the burned surface. Other places on the lower ranges, covered with a rough grass, are not so likely to suffer from fire; the soil is poor, compared with that of the higher ranges, and is more or less stony, and

the existing trees are few and far between. No other spots in the forest seem at first sight so well adapted for a trial plantation of some species of the coniferæ, if at any time it should be deemed advisable to attempt to create a local supply of the soft woods now so extensively imported.

Nearly the whole of the Crown lands adjoining the boundaries to the west and south of the forest have been alienated, and in some cases sufficient notice has not been taken of the timber tracks leading out of the forest. In the course of time the other State forests will stand in the same relation to selected lands, and the importance of preserving these outlets from being stopped should not be overlooked. Old tracks, which generally trend down some leading spur from the heart of the range to the open country, should on no account be blocked by selectors' fences. The greatest attention should be paid by surveyors to the conformation of the country when laying off selections close to a State forest boundary, so as to preserve the best outlets, whether for roads or, more especially, as more likely to be overlooked, for tramways, as the time may come when it will be of great importance to have in the hands of the Government approaches to all the State forests, presenting easy gradients for the construction of such tramways as will be necessary.

The Bullarook Forest.

This forest on inspection presents undoubtedly all the phases through which timbered country in Victoria seems at present certain to pass sooner or later, and within its boundaries the whole of the difficulties of the management of the State forests, both present and future, may be recognised at a glance.

Its central position has caused great demands to be made upon its supply of timber, and the present condition of the forest, resultant upon its having had to sustain this drain upon its resources for years, and upon the methods of getting timber practised by those employed in supplying the neighboring markets, will certainly be that of other State forests as population increases, and these have to supply a larger proportion of the requirements of the country than they do at present, unless some intellectual system of management be brought to bear to check the evil practices of certain classes of timber cutters, and also to devise—from the evidence so plainly presented in numerous parts of this forest—some means—or to decide upon the best methods—of assisting nature in renovating such parts of the land as are denuded of trees, for

the preservation of existing timber, and for the protection of those parts already covered with young trees.

Being in the centre of several mining districts, the resources of this forest have been most extensively trenched upon ; the numerous mills have supplied very large quantities of sawn timber for housebuilding and mining purposes, whilst the immense amount of timber buried in the alluvial mines of Ballarat and other districts has not been obtained without leaving evidence in most parts of the proclaimed area. This vast demand for the alluvial mines has ceased to a great extent, having diminished with the decadence of alluvial mining at Ballarat; and the amount of timber now felled in Bullarook Forest is much smaller than it was a few years ago. If cutting had continued at that rate, but a very few years would have sufficed for the consumption of the timber over the whole reserve. At the present rate this result is not so imminent, as there are some considerable areas of virgin country, and others still more considerable only half cleared, or that have only been touched by the splitters.

The ranges comprising the State forest of Bullarook are chiefly of the silurian formation, the land differing much in quality, from a deep red clay to a poor, thin quartzose soil, the timber being itself sufficient evidence of the strength of the soil, carrying on the deeper clay very fine specimens of stringybark, messmate, and whitegum ; whilst the poorer portions are covered with stunted trees, fit only for firewood, after a few props, perhaps, have been picked out. Other portions consist of a white tenacious silurian clay. This land is wet, covered with rushes, and produces only worthless, stunted timber. There are also in places —as at the head of the Campaspe and along the Ballan and Daylesford road—good areas covered exclusively with whitegum of moderate size, standing thickly together, and of good shape. There are also included within the present forest boundaries a few acres of volcanic soil, and on a small portion of this, as if to show the quality of the timber on the volcanic soil of these ranges, the trees still stand, forming much the finest portion of the whole forest. The remainder of this land has fallen into the hands of the selector, who has rung the trees over thousands of acres, and succeeded in a majority of cases, in exhibiting a disgraceful state of cultivation between the whitened trunks of a crop of timber, that was worth to the State much more than the value of the gross produce of all the grain crops produced or likely to be produced. It is palpable to the most casual visitor that the selector has been the great destroyer of the forests in this part of the country, and in such a centrally situated position, with such a demand for timber, the supply of

which is of vital importance to the great mining interest, it seems to have been a great oversight to have allowed selection before the land had been cleared of timber; at any rate, selection should have been permitted only on condition that the timber be utilized by the selector. Ringing trees, hundreds of years old, many of which would cut 8000 to 12,000 feet of timber, in a neighborhood likely to be denuded of its most available supplies, should in no instance be allowed. Prop-cutters destroy much timber, but their efforts to destroy sink into insignificance when placed side by side with the miles of whitened trees sacrificed to the earth-hunger of the selector on the north side of the Dividing Range. The mischief is here done, but its consummation should act as a warning, and where it is desirable to protect the timber in certain parts of the colony, either for climatic effect or for a supply of timber, ringing of trees should be stringently prohibited.

On the west side of the forest as far east as the Werribee, with the exception of the flat along the road to Ballan before mentioned, the timber may be said to be all consumed. From the head of the Werribee, over the Dividing Range, and towards Trentham, and eastward along the divide, there is much good timber left; also at the head of Mr. Laver's tramway, and southward, at the head of the Campaspe, and on the south side of divide; in fact along the divide and to the south, until one gets within a few miles of the main road from Melbourne to Woodend, there is more or less good timber in places, some a good deal cut into, some hardly touched, but on the whole a fair supply, whilst towards Blackwood still less cutting has been done, owing probably to the more rugged nature of the country.

Between Blackwood and Wiseman's, on the Ballan road, there is a good supply of timber, much not touched at all. On the whole it will take many years to fairly clear out the timber at Bullarook at the present rate of cutting, though doubtless that most easily got at will disappear in a much shorter time.

The cutting of timber in the forest is carried on by the four classes—sawmillers, splitters, prop-cutters, and firewood-cutters.

Irrespective of agreements as to rights of different millowners to cut timber on certain areas, extension of tramways, &c., &c., which have little to do with the conservation of timber, the only restraint that might with advantage be placed upon this class would be the keeping them within certain areas until all the useful timber growing thereon be cleared—in other words, make them clear as they go, and not pick the best trees over large tracts. The reason for this will be stated when dealing with the question of the growth of young trees.

Splitters in this forest seem at present not to require interfering with. The splitting is almost entirely confined to posts and rails. There is not much choice of trees, and but seldom one felled and left, and where there are mills all round such trees are not wasted. The regulation as to stacking tops of trees is not carried out by either of these classes; is in fact impracticable. The utmost that could be enforced, for the purpose of preventing the strengthening of bush-fires by this brush-wood, would be to require the tops of trees to be heaped together and burned, during certain months of the year, when there is but little danger of the fire spreading.

Firewood-cutters frequent only the eastern end of the forest. They should, in general forest management, be restricted to certain areas, and prohibited from entering lands growing young trees, and from cutting immature timber.

In this forest there could be large areas of stunted timber set aside for firewood altogether, for neither is the present crop of trees of value for other purposes, nor is the soil likely to produce anything better, so that it would not be worth while to pay much attention to the growth of young trees thereon. It is to be regretted that the immense amount of timber fit for firewood lying in all directions throughout the forest, in the shape of tops of trees, cannot be utilized. The great bulk thereof is, however, out of the reach of woodcarters; and under present circumstances nothing can be done beyond perhaps to encourage persons to remove such as lie near enough to a market to make their cartage profitable.

Prop-cutters are the men doing really damage to the forest, and their operations should be stopped at once where waste is proved. It is the practice of these men to fell a tree 18 in. to 20 in. at the butt, take off what they want, suitable for an 8 in. prop probably, and leave the rest to waste. Though split props are coming much more into use, still round ones are required in heavy country in the alluvial mines, and it would probably be advisable to alter the regulation as to measurement of trees to be felled, allowing trees 8 in. at the butt to be used, but only under the surveillance of the ranger. A regulation to this effect would be of value in admitting of the proper thinning of young trees when they have reached that size, and promiscuous cutting would be avoided, the cutting of props in this case doing much good in thinning out and giving the remaining trees more room to grow.

A class of men who fell trees for their bark alone should on no account be allowed in the forest; they have committed great havoc in parts of Bullarook Forest. Nothing can be said in favor of the practice. It is wasteful in the extreme, and simply should be prohibited.

The protection from waste being the only object in view, as far as the standing timber is concerned, a few alterations of the regulations, as above hinted, would be all that is necessary on that head; and these would not interfere with the timber industry in any way, which is the second important point to be taken into consideration when dealing with this portion of the subject.

The re-stocking of the denuded areas with young trees is a question second only in importance to the protection from waste of those arrived at maturity, and here again Bullarook Forest presents us with sufficient evidence. This evidence is all in favor of the certainty of nature re-seeding the ground and restoring the forest *under certain conditions.*

It seems in the first instance necessary that, after the timber is cleared off, the whole of the *débris* and undergrowth should be destroyed by fire. A good seed bed is thus formed, and in all cases where this burning has occurred a fine crop of seedlings has sprung up; at present, in many parts of the forest, cut some six years ago and left untouched since, an ample crop of fine seedling trees, three and four years old, exist—the species being both stringybark and whitegum. These young trees are, however, still liable to injury from fire; in fact fire is the great enemy to be combated in the successful restoration of the forests. Until these young seedlings are, say, three or four years old—until the bark at the butts has become somewhat rough—they are very susceptible to injury from this agent; and this fact, added to the evidence in favor of a general seeding after a fire, points out that when a certain portion of the forest is denuded of all its useful timber it should be burned, and the cleaner the better. Thus, the land throws up its seedling trees, and for two or three years there is no accumulation of grass and undergrowth sufficient to support a bush-fire of any strength. After that time the young trees can withstand a moderate fire, and it is a question whether, at this period of their existence, parts of the young forest should not be successively fired—upon such days as a fire would not be likely to get much hold—so as to prevent accumulation of combustible matters over large areas, which on burning would sweep off the bulk of the young trees that had been otherwise protected for years.

In no case in this forest have either the cattle or goats grazing therein done damage to young trees, and whilst there is grass or herbage to feed upon neither of these animals seems to touch the eucalyptus, and they certainly do much good in keeping down the grass, thus assisting in diminishing the fire risk. One further suggestion upon the question of seeding may be of value, and that is, that where used-up forest land

has been burned a sprinkling of the seed of other species of eucalyptus —such as the bluegum, for instance—should be scattered upon the surface in places.

Presuming that we have upon our burned surface a good crop of seedlings, and that, by the judicious use of fire as a preventive against fire, our young trees have reached the age of, say, eight to ten years, when many of them will be of a size that would fit them for props; by judicious cutting, the use of them for that purpose might be made of great benefit to the young forest, as a proper thinning would give room for the remainder to grow. No doubt thinning at an earlier age would also be of great benefit, resulting in increased growth of those left; but there is no use that trees of such an age can be put to, and it would therefore be a question whether it would be advisable to go to the expense of cutting for the sake of the benefits to be derived from thinning. At any rate, when the trees are arrived at the age at which they are of value, thinning could be carried out by making a judicious use of the prop-cutters, but their operations should be under strict surveillance, and all parts once thinned rigidly shut up from all further ingress until it be deemed desirable that further thinning should take place.

As for the purpose of aiding the re-stocking of the forest with trees, it is necessary that all operations of cutting should have ceased before the seedlings are encouraged to make their appearance, sawmillers should be required, as before mentioned, to clear the land as they go of all useful timber, such cleared blocks of land not to be again entered upon.

After due consideration, it does not appear that the question of the proper management of this forest, the prevention of waste, and the initiation of, and the protection of, the next crop of timber, is one of great difficulty in the hands of men who understand and are interested in their work.

The areas used up by the sawmillers might be periodically burned, and by men employed as caretakers or rangers, rather than by the mill-owners; the after-burning, as before suggested, to be conducted by the same men, at such times and where their judgment should decide. At present there are virtually no caretakers or rangers; the existing Crown Lands bailiffs having nominally charge over the forests are not able to carry out the management as it should be done, for several reasons. First, the charge of the forests is only a secondary portion of their duties, upon which they have but little time to bestow. Secondly, even were all their attention given to the forests, they have far too great an

area under their charge. There are but two of these officers in charge of the Macedon and Bullarook forests. At least three rangers are required for Bullarook alone. If justice is to be done to Bullarook Forest it will be necessary to appoint such men; the forest to be periodically inspected by some non-resident officer, who should instruct as to treatment of lands, and see that his instructions were properly carried out, and that the forest regulations were complied with. New regulations should be framed and should be enforced rigidly; the old ones as to stacking tree-tops and the size of timber to be cut abolished. To see to the carrying out of above suggestions, these men would have enough to do, and should confine their attention solely to the forests, and would be responsible for any infringement of the regulations, or neglect on their own part of the growing trees, the Inspector on his periodical visits reporting minutely upon all these points, and all others of interest connected with the preservation and re-stocking of the State forests.

I have, &c.,

W. E. IVEY.

A. R. Wallis, Esq.,
Secretary for Agriculture.

PAPERS.

AGRICULTURAL EDUCATION.

By the Secretary for Agriculture.

In the paper which I wrote on "A Department of Agriculture; its benefits to the community, functions, and management," when the appointment of Secretary to the Department of Agriculture, which it was then proposed to establish, was thrown open to public competition, and which secured for me the position that I now occupy, I pointed out that the most important duty of the new Department of Agriculture would be to consider the best steps to be taken to secure the proper education of the rising generation of farmers; and I have had no cause to alter my views there expressed. Indeed, the more one contemplates, the more evident does the need of a diffusion of the principles of agriculture throughout the length and breadth of the land become. When we look around us, and witness the country lands day by day passing from the State, and day by day the area of exhausted farms extending, and lands which, but a few years since, gave freely their 30 to 40 bushels of wheat to the acre, yielding to-day barely as many pecks, and consider how this state of things has been brought about, the need for a wide dissemination of the principles of agriculture and increased intelligence among the farming classes becomes only too apparent.

But how, let us ask, has this exhaustion been brought about; and again, why is it that the exhaustion of the soil seems inseparable from the system of agriculture adopted in every new country? The first, viz., the exhaustion of the soil, has been due—and I think this view cannot be gainsaid—partly to the want of a more wide-spread knowledge of the principles of agriculture among the farming community, partly to the absence, in the early days, of a market for produce other than grain and hay, and the incentive given to farmers to grow these crops by reason of the high prices ruling in the market. The second results from the facilities offered to persons in every new country to acquire country lands. All classes are thereby enabled to become farmers, if such they may be called, whether they have had any experience in agricultural pursuits previously or not, thinking that a knowledge of how to cultivate the soil is the one thing that is born with every man, and advancing

that when their lands become exhausted there will be still room for them elsewhere. Indeed, it has been repeatedly stated that it pays better to desert an exhausted farm, and seek new land, than to be at any expense restoring fertility to worn-out soil, or even taking ordinary precaution to maintain that fertility. But this system of farm management cannot long continue. The country lands—those, at least, that are best fitted for agriculture—will soon have passed from the Crown; and as the area available for selection becomes restricted, and new land is no more to be had, a rational system of farm management will be forced upon the population of our country districts; and they must be prepared to meet it, or the country will suffer a material loss, by a general falling off in her producing capabilities.

How, then, is this want to be satisfied, this diffusion of the principles of agriculture to be attained? I maintain that it cannot be more effectually accomplished than by following the example so ably set by other countries, and establishing schools in our midst, where a knowledge of the principles of agriculture and the sciences connected with it can be obtained, and thereby raising the standard of intelligence of our farming classes. It is incumbent upon every State to maintain the agricultural capabilities of her territory; and if the people whom she, by the liberality of her land laws, has settled upon the public estate do not possess knowledge sufficient to enable them so to do, it is the duty of the State to supply the means of its attainment. This principle has been freely recognised and liberally upheld by the Government of the United States of America; and the wisdom of the policy of devoting public moneys, and setting apart public lands for the purpose of diffusing a knowledge of agriculture throughout the length and breadth of that country, becomes daily more apparent; and the benefits conferred upon the nation by such expenditure progress geometrically every day.

It was estimated, twenty-five years ago, that to restore the land then under cultivation in the United States to its original fertility would cost a thousand millions of dollars, or about £200,000,000; and to restore the worn-out soil of Victoria would doubtless cost a sum proportional to that amount. These startling figures was it, to a great extent, that caused the United States Government to consider how this evil of exhausting the soil could be mitigated, and how the burden which such a system of cultivation had brought, and if permitted to proceed, would continue to bring, upon the country could be diminished. The same cause will doubtless demonstrate the need for a national system of agricultural and industrial education in Victoria; for it is questionable whether we, who have possessed the land in its virgin wealth, have a moral right to saddle

generations to come with a large national debt, by exhausting its fertility.

But let us pass on to consider how this branch of technical education is to be disseminated, and the nature and organization of the institutions in which it shall be imparted. "Agricultural education in Great Britain," writes Mr. J. H. McChesney*, "is based upon a purely commercial theory. The young man is sent to some advanced farmer, in a good agricultural district, to remain one, two, or three years. Thus he becomes a good farmer, but knows little else. We aim at something higher than this in the United States, and hope to make the young farmer a student, skilled in his profession, by acquiring a knowledge of the sciences on which the art of agriculture is based. For this purpose we must have schools and colleges. Agriculture is at length recognised as a science, and the time has gone by when our journals call in vain for Government and State aid in its advancement, and when intelligent farmers plead in vain for assistance in the establishment of agricultural schools. *The groundwork of our national wealth and power is now appreciated, and a generosity which is truly munificent pervades the Government and people.*"

The aim of agricultural education in Victoria should be the same as that in the United States, situated, as this country is, under conditions not dissimilar from those of America.

Demand for technical education.—The want of a more universal diffusion of practical education, and a more general knowledge of applied sciences, more particularly in agriculture and the mechanical arts, is daily more widely felt. In Europe and in America this need has been long recognised, and the deficiency supplied; and the impression is fast gaining ground that our schools and colleges devote too much time to classics and abstract knowledge, and too little to technical training. Classical education unquestionably has its uses, and is acknowledged to be indispensable to certain professions; but in new countries, where the capabilities of the soil and the mineral wealth of the territory, to a great extent, are unknown, a knowledge of the natural and applied sciences is more serviceable and meets with more prompt recognition, than a knowledge of Latin and Greek. In England, the study of classics has been pursued to the exclusion not alone of the natural sciences, but likewise of continental languages, and even English. The universities of Oxford and Cambridge confer degrees upon students without requiring them to possess any knowledge whatsoever of either German or

* Report on Agricultural Education in Europe: United States Department of Agriculture Report, 1868, p. 129.

French; and the shameful neglect in the teaching of the English language in British public schools has been painfully exemplified by the experience of the civil service examiners. A few years since, and it doubtless is still the case, a very large percentage of those who presented themselves for examination were turned back for deficiency in English composition, and inability to write dictation with even ordinary correctness. But this state of things, let us hope, is rapidly passing away; for certain is it that the study of German and French is year by year increasing in importance, and year by year being more freely acknowledged to be as essentially necessary for general education as is the study of Latin and Greek. We observe this by these languages being now required—indeed rendered indispensable to success—for certain branches of the civil service of England and India, and by their being universally taught in the schools and colleges of the United States. There was a time, too, when Latin and Greek were deemed indispensable for a science student, German and French not so. This day has passed away, and these languages are now recognised to be of equal if not greater importance; for if a science student of the present age will attain eminence in scientific pursuits, he must possess a sufficient knowledge of both German and French to place within his grasp the scientific literature in which both of these languages are so rich.

The establishment of scientific schools throughout the whole of the civilized world, and their ever increasing number, more particularly in continental Europe and America, points to the demand in these days for an education both more practical and useful than that afforded by classical schools. Even the universities of Oxford and Cambridge have yielded to this growing popular demand; and science is now pursued at and scientific scholarships and honours are now bestowed by both. Germany, France, and the other States of continental Europe have their agricultural colleges, their polytechnics, and their industrial schools recognised and supported by the Government, and America has hers; but neither in Great Britain nor in any British colony do we find the branches of learning which are imparted in such institutions either recognised or assisted by the State:—

"Labor," writes Mr. H. F. French,* "is degrading only as it is associated with ignorance and vice. The skilful surgeon, the hospital physician, the great captains by sea and land, perform labors disagreeable, disgusting, arduous to the extreme of human endurance, and yet we reverence and applaud the laborers for their skill, the intellect, the high and noble motives which actuate them. By combining with all labor intellect and skill, or, in other words, by educating the man who performs the labor, we may abolish these distinctions, and place the farmer and mechanic on the same plane with the learned professions."

* United States Department of Agriculture Report, 1865, p. 139.

Should agricultural colleges be separate institutions, or should they be attached to universities?—Opinions are divided on this question, men of eminence, whose arguments are alike conclusive, being found to advocate both courses. Dr. Birnbaum, director of the Academy of Agriculture at Plagwitz, and professor in the University of Leipzig, is strongly in favour of agricultural colleges being attached to, and forming part of an university course. In a speech delivered before the first conference of German agriculturists, which was held at Berlin, in February 1872, he spoke on this subject as follows :*—

"It is known to you, gentlemen, that our agricultural colleges are still divided into two classes, viz., such as are attached to universities, and such as have sprung up and developed in agricultural districts and are established at a distance from any university. I will not allude to the conflict between those institutions, but I remain true to the opinion which I supported at Würzburg, in the year 1863, that I, for my part, consider that that scientific education, which is indispensable for the agriculturist, can be obtained at the least cost and with the utmost completeness only at a university; but I do not dispute that it can be obtained likewise at an academy, if a sufficient professorial staff be provided, in a word, if a large sum of money be expended; indeed, as I from my point of view must add, a large sum of money be needlessly expended. Gentlemen, practice must form the basis of the higher as well as the lower agricultural education; for my part, I have always maintained that our original institutions have attached more importance to practical than to scientific qualification. At that time, the agricultural academies had a perfect right so to do, and have so still in the case of students who have had no opportunity to make themselves sufficiently conversant with practice; but do not forget that, when contemplating a fundamental reorganization of agricultural education, we must know how to discriminate between a practical and a scientific education. It will not be possible any longer to combine the two in one. If I concede only a trifling efficiency to our recent educational establishments, this brings me to a point from which I can detect the chief reason for the small attendance at our colleges, and that is the preparatory education with which our students come to us. There is nothing more unpleasant for a professor of agriculture than to know that he has a class in which a most highly educated young man, one perhaps who has already taken a doctor's degree, sits side by side with those who have

* Bericht über die Verhandlungen des ersten Kongresses Deutscher Landwirthe; Seite 159. Berlin, 1872.

only an imperfect knowledge of the principles of the natural sciences, of mathematics, or of many other branches of learning. But, gentlemen, why are then our universities so much in advance of foreign universities, and of other educational establishments in our own country? Because they have demanded a given standard of preparatory education, and have admitted none who fell short of this standard. In this lies the real pivot of agricultural tuition, a proper organization of our entire elementary instruction; and by that I do not understand alone the scientific, but also the practical instruction. For we can explain to no one what a plough is, and how it must be made, if we do not also take it for granted that he has had such an implement in the hand; we cannot explain in general terms a single object of agriculture, unless we show the object itself to the pupil, or unless we assume that he has had practical experience and thereby become acquainted with the object. The preparatory education, therefore, which we should demand is an absolutely defined standard of scientific and practical training, and for that reason have I brought forward the proposition, that we desire it should be regarded in this aspect universally throughout Germany, and the collective colleges be compelled to admit no one else who falls short of this standard of preparatory education."

The other mode of securing for the student of agriculture the advantages of a scientific education, viz., by means of a separate institution, has an able advocate in Dr. Edward Hartstein, late director of the Poppelsdorf Academy. The following is briefly the substance of his argument.*† "From those who favour the entire disestablishment of agricultural academies and their reorganization as departments of universities, the favorite charge against the academies is their 'one-sidedness' or speciality, and the claim made in behalf of university education is its universality of culture. The accusation against academies and the advantage claimed for universities are a mere form of words, however, unsustained by facts, as an investigation of the university system will prove. Universities do not offer universality of culture. Like agricultural academies, mining schools, polytechnic institutions, schools of art, &c., they are preparatory schools for special life pursuits, not places for that process of diffusion celebrated under the name of universal culture. The division of the universities into four or five departments (as is done in high schools) proves that, to reach their purpose of preparing

* For the full statement of Dr. Hartstein's views see "Die landwirthschaftliche Akademie Poppelsdorf, als Beitrag zur Geschichte und Beurtheilung der landwirthschaftlichen Academien" of 1864.

† United States Department of Agriculture Report, 1868, p. 140.

students for the practical callings of life, there must be a division of studies in accordance with the aims of students. The judicial course is for the study of law, and a demand that the legal student should devote himself at the same time to general scientific and medical studies would be unreasonable; the medical department is also a well-defined course of preparation for one decided life course; and not less clearly defined is the theological course. Those who wish for a thorough revolution of the course of agricultural study do not think of those well organized and clearly defined courses, but expect undefined and mysterious advantages from the absorption of agricultural academies by the philosophical departments of universities. And yet universities complain that the philosophical department, on account of the diversity of its interests, fails in directness. This department includes history, physiology, philosophy, the natural sciences, and mathematics. The desire is to open all these sources of knowledge to the students of agriculture, overlooking the fact that the philosophical department is subdivided into special courses, according to the life aims of the students. No student has yet appeared so universally gifted that he has taken all the heterogenous courses of this department. No one mind can drink from all these fountains. Even one department, the fourth of a university, is too copious for the capacity of single minds. The proposition to divide the philosophical department into two or three departments, now under consideration in different universities, proves how empty is the term 'universality of culture'—a possibility never reduced to a reality. Universities do not exist for the development of universal geniuses, but for the education of useful men for the different pursuits of life. As to the accusation of 'one-sidedness' which is made against the academies, if this means that chemistry, physics, and other branches of the natural sciences are studied, not in their whole compass, but only so far as bearing upon and serviceable to agriculture, this is admitted; but why does not the same reproach rest upon students of medicine, who equally with agriculturists study natural laws in their relations to the profession chosen, not in their complete range and illimitable possibilities? The world has need of good physicians and good agriculturists, but neither need to be accomplished naturalists; with neither is the end furtherance of science, but such a knowledge of the laws of Nature as may be available in the pursuit of their repective avocations. The only way in which academies might advantageously become parts of universities would be by the organization of separate agricultural departments, with corps of professors and all the practical accessories of experimental farms, &c., &c.; and this would have no advantage over a separate organization, as

agricultural academies in connexion with universities, as is the case with Poppelsdorf, having its own faculty and government but still allied to the university, the students of the academy being matriculated at the university. For the teachers the advantages of residence in a university town, association with professors in other departments, and all the accessary benefits of a university, are marked. Then certain of the lectures at the university are available for the students of the academy upon subjects connected with agriculture, yet not warranting professorships in the agricultural institutions. Again, access to the collections and library of the university offer advantages hardly possible to gather about an independent academy. Of all the advantages which follow university matriculation, however, that of association with students in other departments is considered greatest. By matriculation, academy students have the same rank as university students. Independent academies, with agriculture as the single aim, are apt to give too much exclusive tone to the whole life; so that in this respect, and in this respect only, may the charge of 'one-sidedness' be feared—not in the course of study, but in the social life. By mingling with students of the various departments of a university, the free interchange of opinions, the introduction of subjects bearing upon their different courses of study, reciprocal sympathies and interests are awakened, which keep the agricultural student from being merely an agriculturist, the legal student from being merely a jurist. This recognition of the studies and aims of others may give socially an approximation to that 'universality of culture' which might not otherwise be possible. Study must be specific, but sympathy may be universal."

In my opinion a well-organized system of agricultural education by means of academies, situated in country districts, and having farms attached, will be best adapted to the requirements of Victoria. I do not approve of Dr. Birnbaum's proposal to expel farm labor and the benefits which are conferred upon students of agriculture, by having daily access to a farm, from any system of scientific agricultural training, nor do I think with him that the time is come when it is no longer possible to combine a scientific with a practical education in agriculture. This blending of science with practice, by which means we are enabled to demonstrate in the field, the laboratory, or the veterinary hospital what is taught in the lecture room, in my opinion, is the chief object to be attained, the main feature of a thorough and useful agricultural education. It is by no means essential that an agricultural college should stand alone, and have no other course of instruction connected with it; on the contrary, there are many branches of useful technical

learning which might be taught under the same roof. In America agricultural and industrial colleges, in which are taught agriculture, forestry, horticulture, and the mechanical arts, are combined; and in Germany agricultural education institutes embrace the teaching of agriculture, forestry, horticulture, the application of chemistry to brewing, beet-sugar, starch, vinegar, and other manufactures. There can be no reason why all these and many other branches of technical education, not enumerated above, should not be included in any system of agricultural and technical education hereafter to be developed for this colony. By this means not alone would economy be effected, but agricultural colleges would be placed within the reach of a much larger section of the community. Agricultural colleges, in fact, would be converted into colleges of natural science and technology—institutions in which a scientific and practical knowledge of every industrial and mechanical art could be obtained. And these institutions would supply us not only with young men who, by reason of the diversity of their technical knowledge, would be prepared to go forth and develop the latent resources of the country, but also with young men trained in the science and art of forestry, who would hereafter find employment as rangers of our State forests; and thus would this country be spared the expense to which India has been put in obtaining and training on the continent of Europe, and subsequently in Scotland, young men to superintend the management of her forests. The necessity for a Department of State Forests was forced upon the Government of India by a wood famine, brought about by the wasteful use and needless destruction of her timbered areas, and a similar result seems to await Victoria. The woful want of knowledge in this country of the principles of agriculture and forestry is brought daily more prominently under our observation. This deficiency will have to be supplied ere long, and when that time shall come—and I trust it is not far distant—the system, in my opinion, which will be best adapted to the requirements of this colony will be that which combines a scientific with a practical training in a separate college of agriculture and technology—not that which professes to afford a practical and useful education by making agricultural colleges mere adjuncts of universities, situated as a rule in the centres of large cities.

Agriculture in State schools.—It has been frequently advanced that the teaching of agriculture might be introduced with advantage into a State school course. I am not an advocate of this view, nor do I think that the interests of agriculture would be advanced one iota by its adoption. I consider that the minds of children at the period of life which belongs to the State school course are not fashioned sufficiently for such studies, and that their whole time is needed for its expansion

in general directions. I do not, however, dispute that the instruction in State schools could be made such as would tend to create in the minds of the children a desire to pursue in after life, not agriculture alone, but likewise every other branch of scientific learning; and I think that many apt illustrations of the practices of agriculture and the elements of agricultural science, as well as the application of science to the arts and manufactures might be found, which would inspire the children with a desire for the observation of natural objects, and a wish in after life to study agriculture or some other branch of technology, with the object of pursuing the same as a means of livelihood. There can, I think, be no doubt that it is a mistake to try to force the study of any given profession upon a child. None realize this principle more thoroughly than do the Germans, and none have a higher claim to be deemed an authority in this matter, for nowhere has education received greater attention, and in no country are the collective courses of study so complete. The Germans advance that the first thing to be considered in the education of a child is to teach it how to think correctly, and this they state can be best accomplished by the study of languages, be they modern or dead languages. When once the child has acquired the art of correct thought, and can relate in a clear and intelligent manner what it has read, learning henceforth will be comparatively easy; and the early training of every child they contend should lean in the same direction, but vary of course with the capacity of the child. As soon as the mind of a child shall have been modelled by a thorough groundwork of the principles of intellectual training, and the child shall have passed through the period of youth to that of early manhood, he will decide of himself what line of life he would select to follow; and then is the time to afford him the special training which is essential to success, and without which he cannot rise to eminence in his profession. Be it remembered that the notion, too frequently expressed, that this child shall be educated for one profession, and that for another, is immature and ill-considered. It is seldom that a child acquires eminence or even proficiency in after life if compelled against his inclination to pursue any given profession. The same rule holds good in agriculture. The old plan of making a good practical farmer by neglecting the early education of the child, and putting him in his boyhood to farm work, is fast exploding. By such means boys are converted into laborers, not good farmers and intelligent masters of labor. The principle, I believe, is generally recognised, that if a boy in the present age is to acquire eminence in after life, be it in agriculture or any one of the so-called learned professions, his intellectual and moral training when a child must not be neglected.

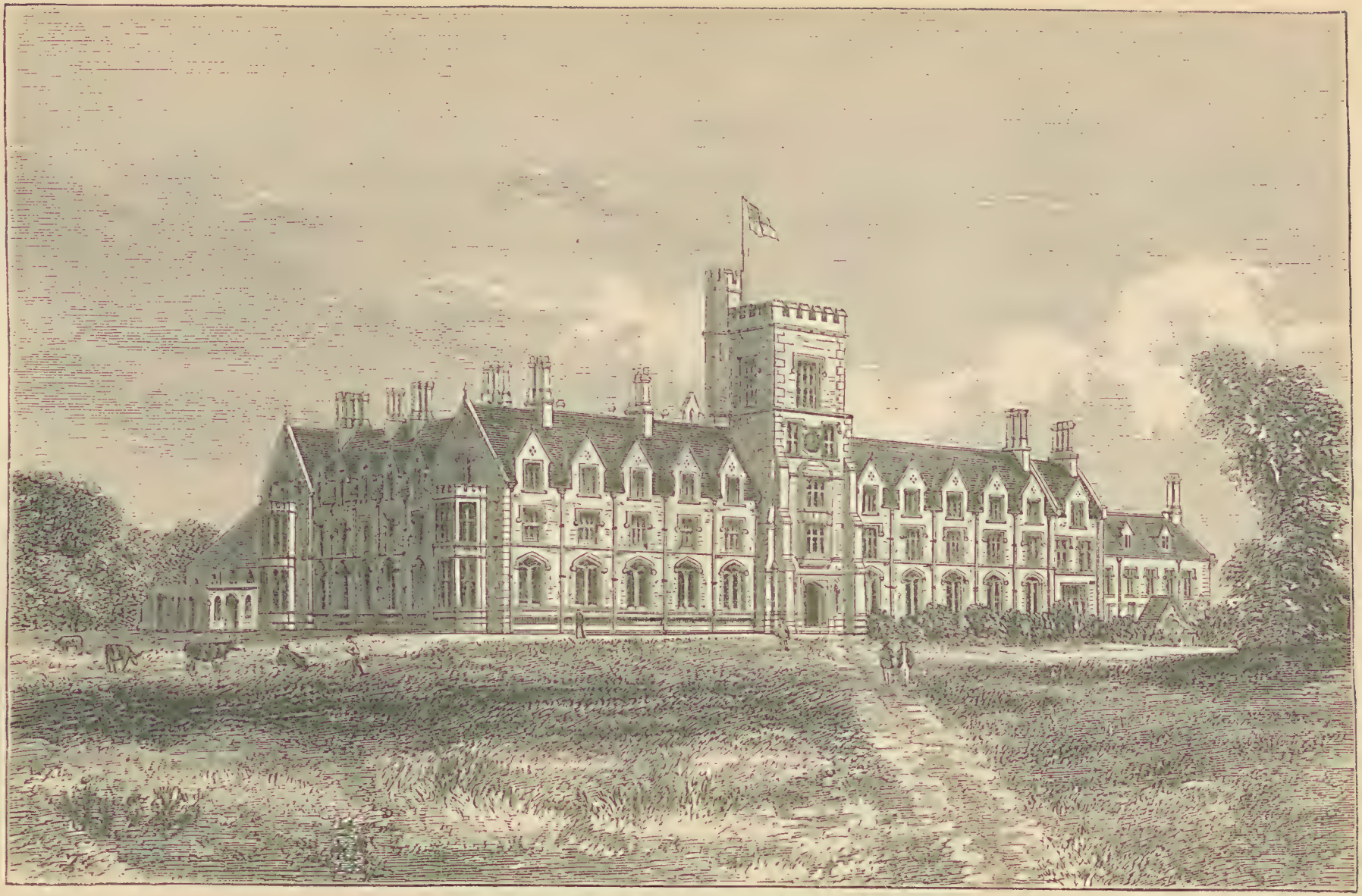
"It is beginning to be generally understood," writes the Rev. B. E. Dwarris, hon. canon of Durham,* "that if he is to make two blades of grass grow where one grew before, he must have all the resources of science at his command; he (the farmer) should not be at the mercy of better accountants, better surveyors, better land-measurers, better mechanicians, better draughtsmen than himself; he should at least know enough in each department to be able to avail himself intellectually, without being imposed upon, of the sciences of experts in each branch. Then he should have acquired somewhere methodical habits of business, and the power of commanding men; he should be able to speak and write correctly in his own language, and to read the transactions of foreign clubs. He should not be unarmed in general history, or altogether ignorant of political economy; he should be able to interpret an Act of Parliament. But, indeed, even all this is not enough; we must look deeper than any information if he is to be able to use such information beneficially when he has got it; we must look to what is less interesting and more useful, to his being well grounded, *i.e.*, to the cultivation of his mind. I mean to his having the powers of his mind strengthened at school, to his having acquired habits of close and accurate thought. For if afterwards he forgets every detail of his lessons, but carries away from school a brain sharpened and polished as an instrument for use, and a few first principles which will stand by him all his life, do you think he will have gained nothing? Now this distinction which I would here make is from the outset all important, viz., that real education does not mean making a farmer, but a man. This is the difference between general education and a special or professional training. Each has its proper place, but it will not do to put the cart before the horse; make a man first, and a real man will make into anything—farmer, merchant, artisan, doctor, lawyer, anything you please. On this depends the distinction which I would make between the school for boys and the college for young men. The school should make the boy into a man, the college should make the man into a professional man; all experience of education goes to confirm this view."

Manual labor as part of an agricultural student's course.—There is a division of opinion as to whether manual labor should be rendered compulsory or not, or whether it should form any part whatsoever of a college course. In some institutions labor forms part of a student's course of study, and in others again it is voluntary, the student being free to engage himself in farm work more or less as he may see fit or be able to spare the time, while in agricultural colleges which are attached to universities it is, as a rule, dispensed with altogether. I am of opinion that manual labor should be rendered voluntary, and that students who devote their time thereto should be allowed a fair remuneration for their work, which should be set off against the college fees, as is done in some of the American colleges; but no student should receive the college diploma who did not qualify in practical agriculture. Though I advocate voluntary manual labor, I would not have it inferred that I wish to exclude practical farm classes from the

* "The Education of the Farmer;" *Farmer's Magazine*, June 1871, p. 480.

course of an agricultural student. Far from that, I consider that the demonstration in the field of what is taught in the lecture hall is a most important part of a student's education, and I would not alone render attendance at such classes compulsory, but non-attendance punishable. I would, however, leave it to the student himself to decide what additional farm work he should perform. Students who have had no previous training in practical agriculture will find it incumbent upon them to devote a portion of their spare time to practical work upon the farm, while those who have enjoyed the benefit of two or three years of practical agriculture before entering upon their college course will have more time to devote to laboratory work or some one other of the practical branches of study. In Germany and Bohemia agricultural schools are divided into three classes, viz., 1, such as are attached to universities, and in which manual labor is dispensed with; 2, agricultural academies, in which labor is voluntary; and, 3, schools of practical agriculture (*Ackerbauschüle*), in which manual labor is compulsory and forms the principal part of a student's course. The two last are frequently combined in one, but the courses are distinct. In any system of scientific agricultural education which hereafter may be drawn up for Victoria, it will, I believe, be best to make manual labor voluntary, and to reward students who may wish to engage themselves in farm work during their spare time in proportion to the labor which they may perform, and make such reward a set-off against the education fees.

Is a farm necessary?—The question whether a farm is a necessary adjunct of an agricultural college will depend upon whether the college is attached to a university or whether it be a separate and independent institution; and again, whether manual labor or demonstration by means of practical classes be deemed an essential part of an agricultural student's college education. In a system such as I advocate in this paper a farm will form not alone a necessary but also an indispensable section of an agricultural college. I deem it to be most important in all matters to combine science with practice, and thereby to impress inerasably on a student's mind, by demonstration in the field or elsewhere, the theories of the lecture hall. I am aware that many advanced thinkers on this subject do not agree with me in this particular; but the conditions under which they and the persons whose interest and advancement they advocate are situated differ widely from those of Victorian farmers, and I contend that a college without an attached farm will not meet the requirements of this country, at least under present circumstances. Mr. Klippart, in an address before the agricul-



ROYAL AGRICULTURAL COLLEGE, CIRENCESTER, ENGLAND.

tural convention of Ohio, referred to a conversation between himself and the late Baron von Liebig, in which the Baron says—"You want to teach agricultural science in the same manner that medical science is taught—that is, by a series of lectures delivered by competent professors. You must not trouble yourself about teaching practical agriculture. The several lecturers on the several branches of agriculture can make excursions of one or two days every week in different parts of the State, and can see and examine the operations on the best farms in the State. In this way they will learn what the present system and practice is with the best farmers; many improvements in the manual part of farming will thus suggest themselves to the students, which they can put into practice themselves. But you must teach the science of agriculture as purely, that is, with as little reference to application, as the science of geometry or trigonometry is taught."

A portion of any attached farm should be devoted to experimental and test purposes. The object of the experimental portion should be to show how to obtain the greatest crops with the least outlay and without impairing the fertility of the soil, to test new varieties of grain and other farm produce, and to conduct series of experiments with the different commercial and other manures for the purpose of testing their relative fertilizing powers and applicability to the several crops of the farm, and for the illustration of the lectures on agriculture and agricultural chemistry. The remainder of the farm should be conducted not as a model farm, but as a farm worked for profitable ends and managed upon the most modern and improved systems of agriculture. It should, in fact, be a complete school of approved husbandry, based on strictly scientific principles.

But let us pass on to the consideration of the systems of agricultural education existent in the different countries of the civilized world, taking as examples one or more of the institutions in each of those countries.

AGRICULTURAL EDUCATION IN GREAT BRITAIN.

The Royal Agricultural College at Cirencester.

The Cirencester Agricultural College, unfortunately for British agriculturists, is the only one of its kind in Great Britain. The institution was founded by a few energetic and far-seeing persons—among whom the late Mr. R. J. Brown occupied a prominent position—under circumstances of very great difficulty, and was incorporated by Royal

charter, 27th March 1845. The college is situated about one mile and a half from the town of Cirencester, in the centre of that portion of England known as the Cotswold Hills.

The Building.—The building is a handsome and commodious Gothic structure, and has a frontage facing towards south of 190 feet. It includes a chapel, dining-hall, library, museum, lecture-theatre, laboratories, class-rooms, private studies, and servants' offices; with apartments for resident professors, and ranges of dormitories on the upper floor. The whole building is lighted with gas, and the most approved methods of warming and ventilation have been adopted. Each student has a separate sleeping compartment, but a study is shared between two. There are, in addition to the studies, several private rooms, which, when vacant, are allotted to meritorious students.

Education.—Instruction is imparted by means of lectures and practical classes. The course of study extends over a period of two years, and embraces instruction in agriculture; chemistry, inorganic, organic, and agricultural, including analytical work in each branch; mathematics, including mensuration, book-keeping, surveying, and mechanics; natural and mechanical philosophy; natural history, embracing botany, geology, and zoology; veterinary science, including anatomy, physiology, pathology, and therapeutics; architectural and mechanical drawing, including exercises in plan and machine drawing, and the designing of farmsteads and other agricultural buildings. Opportunities are likewise afforded students to acquire a knowledge of carpentry and smith's work, but these are voluntary. The college year is divided into two sessions, each extending over a period of four and a half months, and commencing on or about the 1st August and 1st February respectively; and the lectures are distributed over the sessions as follows:—

First session.—Agriculture (soils, manures, implements), chemistry (inorganic), mensuration, book-keeping, geology, botany, anatomy and physiology, drawing (plan).

Second session.—Agriculture (crops), chemistry (organic), surveying, geology, botany, zoology, pathology, drawing (mechanical), book-keeping.

Third session.—Agriculture (stock and labor), chemistry (agricultural), mechanics, geology, botany, therapeutics, drawing (designing), book-keeping.

The fourth session is known as the diploma session. Candidates for the same have to qualify in agriculture, theoretical and practical, chemistry, inorganic, organic, and agricultural, including qualitative and

quantitative analysis, book-keeping, and any fourth subject which the student may select. Diploma students have no fixed course of lectures, but are free to attend such as they may see fit to insure their qualification.

Agriculture.—Instruction in agriculture is given by lectures, and daily practical classes on the farm. The agricultural course of instruction thus embraces not only a scientific discussion of established methods of cultivating different kinds of soil in different climates—of the breeding, rearing, and general management of stock, and of the use of machinery—but also affords a good illustration of the cultivation of a farm. The students have free access to the college farm, and may engage in any kind of work upon it which they may select. Moreover, they are encouraged to occupy their spare time with practical farm work, by the offering of prizes for ploughing, the management of stock, and other description of farm labor. This system has proved not alone highly beneficial to the students, by creating an interest for farm-work and a spirit of emulation among them, but likewise most advantageous in furthering the object of the institution, viz., to combine a scientific with a practical education. Each student is expected to keep a daily journal of all the operations on the farm, and to make himself thoroughly acquainted with the accounts.

Chemistry.—Instruction in this subject is imparted by illustrated lectures and chemical manipulation and analysis, both qualitative and quantitative. The chemical laboratory is a well arranged and well furnished department of the institution; and chemical manipulation and analysis are taught to each class of students in succession, under the superintendence of the professor of chemistry and his assistants. After studying the properties of the more commonly occurring substances, the students are taught to analyse a series of compounds, proceeding from simple to more complex cases, and to apply the knowledge thus obtained to the analysis of manures, soils, ashes of plants, farm products, and other substances with which the practical agriculturist is more immediately concerned. Analyses of artificial manures, oil-cakes, waters, &c., are daily performed in the college laboratory, and chemico-agricultural researches undertaken by the more advanced students, under the immediate direction of Professor Church and his assistants.

Mathematics.—Instruction in mensuration, and those mathematical subjects which are connected with surveying and mechanics, includes lectures and field classes. Regular and frequent opportunities are afforded for the measurement of stacks, earthworks, &c., and for practical work in the field in surveying, levelling, and for learning the use of the theodolite, spirit level, and other instruments.

Natural History.—During the winter months lectures are given in geology, and demonstrated by excursions made in the surrounding neighborhood, in which the different formations from the silurian to the chalk are easily accessible.

In the summer the lectures include courses on structural and systematic botany, and practical lessons, in which students are required to write out descriptions of plants dissected by themselves. The lectures are illustrated by extensive collections and diagrams. The materials for the practical work are supplied from the Botanic Garden attached to the college, which contains large collections of indigenous and exotic plants.

Veterinary Surgery.—Instruction in this department includes lectures on anatomy, physiology, pathology, therapeutics, and hygiene, illustrated by cases in the hospital attached to the college. In order to make the teaching in this department as practically useful as possible, students are required to record the particulars of all cases admitted for treatment, especially the results of *post-mortem* examinations. A dissecting room is attached to the hospital, where instruction in practical and comparative anatomy is afforded to students, who select to avail themselves of it.

Natural and mechanical philosophy is taught by a series of lectures delivered by the principal; *architectural and mechanical drawing* by the certified master from the Science and Art Department of the Committee of Council on Education, South Kensington; *carpentry and smith's work* in the shops attached to the farm buildings.

The Museum.—An extensive and well arranged industrial and scientific museum forms a most interesting and useful accessory of this institution. It contains many valuable collections, and is divided into departments as follows, viz.:—An agricultural, a chemical, botanical, geological, mathematical, and veterinary, which are placed under the care of the corresponding professors, who attend to explain the specimens in their respective sections on given days and at stated hours. The college museum contains geological specimens, a collection of minerals scientifically arranged, objects of natural history, a case illustrating the analysis of agricultural products, collections of seeds, wax models of fruits, vegetables, and every variety of cultivated roots, interesting anatomical and pathological preparations, including casts of teeth, to illustrate the age of the horse, sheep, and other animals, and also an herbarium containing a large and varied collection of prepared specimens.

The College Farm.—The farm contains about 500 acres, of which 455 are arable, the remainder in permanent pasture. The soil rests upon the forest marble and great oolite, and varies in quality from a

tenacious clay to a light stony brash. The entire farm, excepting 30 acres devoted to experimental and test purposes, is tenanted to Mr. R. Swanwick, who is a graduate of the college, and one of the most advanced agriculturists of Great Britain, as his success as an exhibitor of stock at the first agricultural exhibitions of the world, and his skill as a manager, testify. The farm is conducted upon the most approved modern systems of husbandry, consistent with profitable agriculture, and thus affords an excellent school of practical farming for the students.

The Experimental Farm.—This department contains 30 acres, of which about 6 are in permanent pasture, the remainder under the plough. The whole of the cultivated portion which is under crop is divided into sections, varying in size from $\frac{1}{40}$ of an acre upwards. These plots are sown with different crops, and treated experimentally in duplicate; and by accurate records, and the systematic weighing of animals and products, students are enabled to secure exact notions on most of the important details of farm practice. Records of the results of experiments on the farm are published in the Journal of the College, and in other agricultural and scientific periodicals.

The University of Edinburgh.

In contradistinction to the system pursued in the Cirencester Agricultural College, the Department of Agriculture attached to the University of Edinburgh serves as an illustration of colleges of agriculture, where the science of agriculture alone is taught. The chair of agriculture is filled by Professor John Wilson, an eminent scholar, and able teacher of the science of agriculture. The course extends over two sessions, and yearly more importance is attached to it. The first is occupied in discussing the principles, the second the practice, of modern agriculture. In the first session lectures are delivered upon the history of agriculture, general aims of agriculture, the chemistry of agriculture, the geology of agriculture, the botany of agriculture, and physics in their relation to agricultural practice. The second session is occupied with the mechanics of agriculture, rotations of crops, mechanical improvement of the soil, breeding and management of live stock; the economics of agriculture, including butter and cheese making, malting, brewing, beet-sugar manufacture, &c.; farm engineering, and construction of farm buildings; agricultural policy, including size of farms, relation of landlord, tenant, and laborer, wages, statistics, &c.; and general management and improvement of landed property. The students have access to one of the best industrial museums in existence.

The university works in conjunction with the Highland and Agricultural Society of Scotland, and confers a diploma upon any student who qualifies in the prescribed subjects, whether he has attended the college course or not. Hence, many students who pass the Royal Agricultural College at Cirencester afterwards take the degree of the Highland and Agricultural Society of Scotland.

Agricultural Experiment Stations.

The most celebrated of these is unquestionably that of Mr. J. B. Lawes and Dr. Gilbert, at Rothamstead, in Hertfordshire. Experimental stations are likewise attached to the Cirencester Agricultural College and to the Highland and Agricultural Society, and a series of field experiments are carried on year by year by different agriculturists throughout England, under the direction of Dr. Voelcker, chemist to the Royal Agricultural Society. The workings of Messrs. Lawes and Gilbert in the field of experimental and scientific agriculture are almost beyond the limits of description and praise. Mr. Lawes commenced his labors now over 30 years ago, and with each year have they extended, both in interest and usefulness. The results of all the experiments have been carefully recorded and compared, and the information published from time to time, for the guidance of agriculturists, in the "Journal of the Royal Agricultural Society," and other periodicals. Messrs. Lawes and Gilbert, by private enterprise, have done and are doing much for the advancement of agricultural science and its application to the practice of husbandry, and have thus bestowed inestimable benefit on tenant farmers and holders of landed properties. Such workings, however, can only be carried on by private persons who, on the one hand, possess the necessary scientific qualification, and, on the other, have an ample purse to support them.

In a like, though lesser, degree have the labors of the other experimental stations of Great Britain been serviceable to the community at large.

Agricultural Societies.

Much has been and is still being done by the labors of these bodies. The show-yard is an important school for the farmer in after life, for by its instrumentality is he enabled to compare his stock, his produce, and his implements with those of his neighbor, and also with farmers from every other district of the country, and discern in what particulars his are superior or inferior. He can also examine new inventions in machinery and see them practically tested, which serves to guide him

in his choice when he may require to replace his worn out stock. But agricultural societies in Great Britain, of late years, have aimed at still higher results ; and the leading institution of the kind, both in Scotland and England, has established in connexion with it a course of scientific study, and bestows its diploma on candidates who present themselves for examination and qualify in the prescribed subjects. The examination of the Highland and Agricultural Society has been referred to in the remarks upon the University of Edinburgh. The other society which has adopted this course is the Royal Agricultural of England. Its examinations are held in the month of April in each year, and the subjects embrace all of the sciences connected with farming pursuits. The examiners are selected from among the leading scientific men of England, and the most experienced and notable practical agriculturists, whose reputation in their several branches of learning and industry is sufficient to guarantee the scientific and practical attainments of those who qualify, and to give to the diploma of the Royal Agricultural Society a place among the scientific degrees of Great Britain.

Agricultural Education in Ireland.

The subject of agricultural education has received greater attention in Ireland than in any other portion of the British Empire. The disastrous results of the potato famine, the low standard of practical skill, and the total absence of knowledge of the principles which regulate rational agricultural practice on the part of cultivators, demonstrated to the Government the absolute need for disseminating information of the principles and practice of agriculture among the tillers of the soil. Prior to the year 1840, the rotation of crops was hardly known amongst the small farmers of Ireland. Their knowledge of cultivation did not, except in extraordinary instances, extend beyond the growth of potatoes and oats, and the management of pasture lands, and even these were conducted in the rudest and most primitive style. The two crops above mentioned were frequently grown year after year until the land became thoroughly run out, and even to this day the same practice obtains in certain districts. The disastrous results of this system of spoliation were made evident by the potato famine, which appeared in 1846, and which brought indescribable misery upon the rural population of Ireland, though it demonstrated the need for the diffusion of correct information on the subject of farm management, *at the public expense*, throughout the length and breadth of the country, and thus in the long run contributed towards the public good by placing

the recurrence of so terrible a disaster beyond the limits of probability. The systematic exhaustion of our agricultural land, through want of knowledge of how to use it on the part of the occupants, will, it is feared, bring a similar calamity upon Victoria.

"It was in the year 1831," writes Mr. R. O. Pringle,* "that a commencement was made with the present system of national education in Ireland. At a very early period in the history of the movement, we find the Commissioners acknowledging the utility of diffusing among the people correct information on the subject of agriculture, and stating their willingness to apply it; they appear, indeed, to have taken it up earnestly as far back as 1838."

"At first they confined their efforts principally to the establishment of a school of agriculture at Glasnevin, near Dublin, where they took a moderate-sized farm, and erected upon it suitable offices. Two classes of persons received instruction:—First, the schoolmasters trained in the Normal Training Establishment in the city, who went out to the model farm regularly for instruction, the object being to qualify them to teach agriculture in their several districts when they returned to their schools. Second, a number of young men, who were received as agricultural boarders and trained as professional agriculturalists, in the hope that they would afterwards be employed by the landed gentry of the country in instructing their tenants."

"The Commissioners were engaged in pursuing their system of agricultural instruction when, at the end of 1843, the Royal Commission, known as the Devon Commission, was appointed, and proceeded to make a searching inquiry into all matters relating to the agricultural interest of Ireland. Landed proprietors, land agents, practical farmers, and professional men acquainted with the state of Ireland and interested in promoting its prosperity, were examined. It is remarkable that, to use the words of the 'Digest' of the report of the Devon Commission, 'There appears to have been no difference of opinion amongst the witnesses as to the advantages to be derived from an extended establishment of agricultural schools.'

"The favorable way in which agricultural schools were mentioned in the report, and the strong evidence given in their favour by the witnesses, naturally assigned to them a high place among the agencies for mitigating the evils of the famine, and preventing a recurrence of it. One or two references will show how deep a hold the question took on the gentry at the time."

"The empire has produced few men who were supposed, and with good reason, to understand the wants of Ireland better than Lord Mounteagle. When at the zenith of his influence, he addressed a remarkable letter to the Commission, embodying suggestions for the establishment and government of agricultural schools. This document will be found in the Report of the Commissioners of National Education for 1847, and it contained the following passage:—

"'It is wholly unnecessary to dwell on the importance of agricultural education, But I may be permitted to observe that what, before the blight of the potato, was a matter of undeniable usefulness, is now, by this casualty, made a matter of indispensable necessity. We are called upon, *under the penalty of famine*, to teach our people modes of cultivating better crops.'"

* "Agricultural Education in Ireland;" *Journal of the Royal Agricultural Society of England*, 2nd series, vol. ix., part ii., p. 422.

"The original ideas of the Education Commissioners, when they embarked in agricultural education, was to blend agricultural with literary instruction in as many of the rural national schools as possible. But, urged on by the gentry, they were induced to enlarge their plans. Applications were made to them from all parts of the country for aid towards establishing agricultural schools of a more comprehensive class than they at first contemplated. In their report for 1849 they say—

"'We have, during the past year, received a considerable number of new applications for grants towards the establishment of model agricultural schools. We have found it necessary to postpone our decision upon twenty of these applications.'"

"Ultimately the Commissioners yielded to the appeals made to them, and established, solely at the public expense, in various parts of the country, a number of model agricultural schools."

"There are now in operation throughout Ireland seventeen of these model schools, exclusive of the Albert Institution at Glasnevin. From a variety of causes it happened that, for several years, the farms attached to these schools did not pay; and this circumstance nearly brought the whole proceedings of the Board into disrepute. This state of matters, however, has latterly been altered for the better."

After making a few remarks on the objects of the Glasnevin or Central Agricultural Institution of Ireland, Mr. Pringle adds—

"Objections have been raised, occasionally, against the system of having young men trained by the State to become farm bailiffs or agriculturalists for landed proprietors; but such objections have emanated from persons who are unacquainted with the state of Ireland. It is to be borne in mind that the system of national education was founded for the benefit of the mass of the population; and the Commissioners believed it was their duty to aid and encourage every young man of talent and promise to advance himself, for they knew that in advancing himself he must benefit the State. Hundreds of intelligent, well-educated men, trained at the Glasnevin Agricultural Institution, are now centres of enlightenment in their respective districts; and the Commissioners are of opinion that none of them are repaying the State for the cost of agricultural instruction so thoroughly as those who are acting as estate agriculturalists, advising, instructing, and directing tenants of great landlords. Of the importance of that class of estate officials I have already written fully; and I must say that, if the landed gentry of Ireland understood their interests, they would employ, in this capacity, every talented deserving man who has been trained at Glasnevin."

"In the improved circumstances of Ireland, many of the young men who now seek admission to the Glasnevin Agricultural School are the sons of persons who are able to pay a moderate fee for the education of their children. Accordingly the Commissioners insist that persons of this class shall pay a fee of £20 a year for the agricultural training afforded to them at the institution. The greater number of the pupils are, however, those who are boarded and educated wholly at the public expense, and who are admitted by competitive examination, suggested in 1860 by the Right Hon. E. Cardwell, then Chief Secretary for Ireland."

Mr. Thomas Baldwin, Principal of the Glasnevin Agricultural College and Superintendent of the Agricultural Department of National Education

in Ireland, explained the model farm system of affording agricultural education which has been adopted with such marked success in Ireland, in a speech delivered before the North-East Ireland Agricultual Society, as follows* :—

"One branch or grade of the board's system of agricultural education was afforded in the model farms, to which the meeting wished that he would, on this occasion, more particularly address himself. Of the model farms, it may be said that their establishment was forced on the Commissioners; that is to say, the results convinced all classes that the state of agriculture which had prevailed should, as far as possible, be superseded by a new system; and many good and wise men advocated a system of model farms, as one of the means of accomplishing that object. The Commissioners yielded to the demands made upon them, and established some twenty of these farms throughout the country. It was not in his province to offer any opinion on the policy of the course pursued; but he could state, for the information of the society and of the public, that the farms, as farms, are now, one with another, paying a satisfactory amount of profit, and exhibiting judicious modes of farming, The literary instruction of the pupils is directed by one of the best masters in the empire, who has also charge of the general discipline. There is adequate assistance, so that at the school you have at present a staff competent to afford a sound general literary and agricultural education. They teach the elements of chemistry, of physics, and other branches relating to farming; and the general education includes land surveying and mapping. The day is divided equally between practical agriculture, including outdoor business, and the cultivation of the mind. The head is stored with general knowledge, and the head and hands are turned to skilled practices. With the view of placing this excellent general education and special training in improved ideas and practices within the range of all classes, the fee for paying pupils is only £2 a quarter, including board and education, the Commissioners contributing the additional amount required to provide suitable diet; and in order that young men of intelligence and promise, who evince a decided taste for farming, but whose parents or friends may find it inconvenient or impossible to pay £2 a quarter, the Commissioners take in four pupils without any fee. These free places are given away by competitive examinations. Of young men who seek admission to qualify themselves for farming a high standard of proficiency is not required. If they can read with intelligence, and write a fair hand, and do a little ciphering, they are admitted. A higher standard is required from those who intend to become land stewards, agriculturists, and agricultural teachers. They must be persons who, by their intelligence and aptitude for agricultural pursuits, would, by promoting the public good, render the State an adequate return for the cost of their agricultural training. There is a central Agricultural Training Institution at Glasnevin, near Dublin, and to which the pupils who receive a preliminary agricultural training at the provincial schools are drafted from time to time. At present the great number of pupils at Glasnevin are free, admission being obtained half-yearly by competitive examination. Well educated persons from all parts of the country

* *Irish Farmers' Gazette*, 1872.

are allowed to compete; the most intelligent and promising are selected. It is competent for a boy who fails to obtain a free place to become a pupil on paying a fee of £5 per quarter. Paying pupils are also admitted at all periods of the year. Some of these young men go to farm for themselves or for their parents; a large number seek employment as stewards, agriculturists, and agricultural teachers. For a long time a well-founded objection was raised to them by the landed gentry on the ground of youth and inexperience. They are sent out as working stewards to the larger model farms, and, as opportunity offers, as assistants to clever stewards and successful farmers. A young man enters the Belfast farm, after his pupilage there he goes to Glasnevin, from Glasnevin he is sent as a working steward to the model farm at Kilkenny, Cork, or Athy. He often undergoes a four or five years' training before he is recommended to a country gentleman. This arrangement has worked admirably. The demand is increasing, in proof of which this one fact may be mentioned, that while the course of training at Glasnevin is two years, there is not at present a pupil of eighteen months' standing; and at the present moment nine persons are wanted to fill situations that require a good deal of agricultural knowledge, as well as intelligence and trustworthiness. An admirable arrangement has been commenced by Lord Clancarty, who has been good enough to encourage his steward, Mr. Nesbitt, himself a Glasnevin man, to take six Glasnevin men as apprentice pupils to finish their agricultural training on the home farm at Garbally. All he would say, in conclusion, was that it appeared to him that no man who understood the state of Ireland could for a moment doubt the utility of such a system of agricultural training as he had now endeavoured to explain."

Agricultural education has worked wonders for Ireland, and has raised her small tenant-farmer class from a state of wretchedness, if not need, to one of comparative prosperity and happiness, has elevated an important section of her community from a state of obscurity to one of intelligence and usefulness. When the Commissioners began to make grants for agricultural instruction, the rotation of crops was scarcely known amongst the small farmers of the west of Ireland. Now the knowledge of the rotation of crops is extending; the growth of root crops, and of artificial grasses, is also increasing, and in due time correct ideas on all subjects relating to the proper cultivation and management of their holdings will prevail among the people.*

The late Lord Palmerston, in a speech on the expediency of devoting public money to the advancement of agricultural education in Ireland, delivered in the House of Commons, used these words:—

"There could not possibly be a better application of money in Ireland, than in teaching the peasantry and small farmers how best to cultivate the soil, for they did not know how to realize, to the best account, the natural resources which lie undeveloped in the soil they tread."

* "Agricultural Education in Ireland;" *Journal of Royal Agricultural Society of England*, 2nd series, vol. ix., part ii., p. 425.

AGRICULTURAL EDUCATION ON THE EUROPEAN CONTINENT.

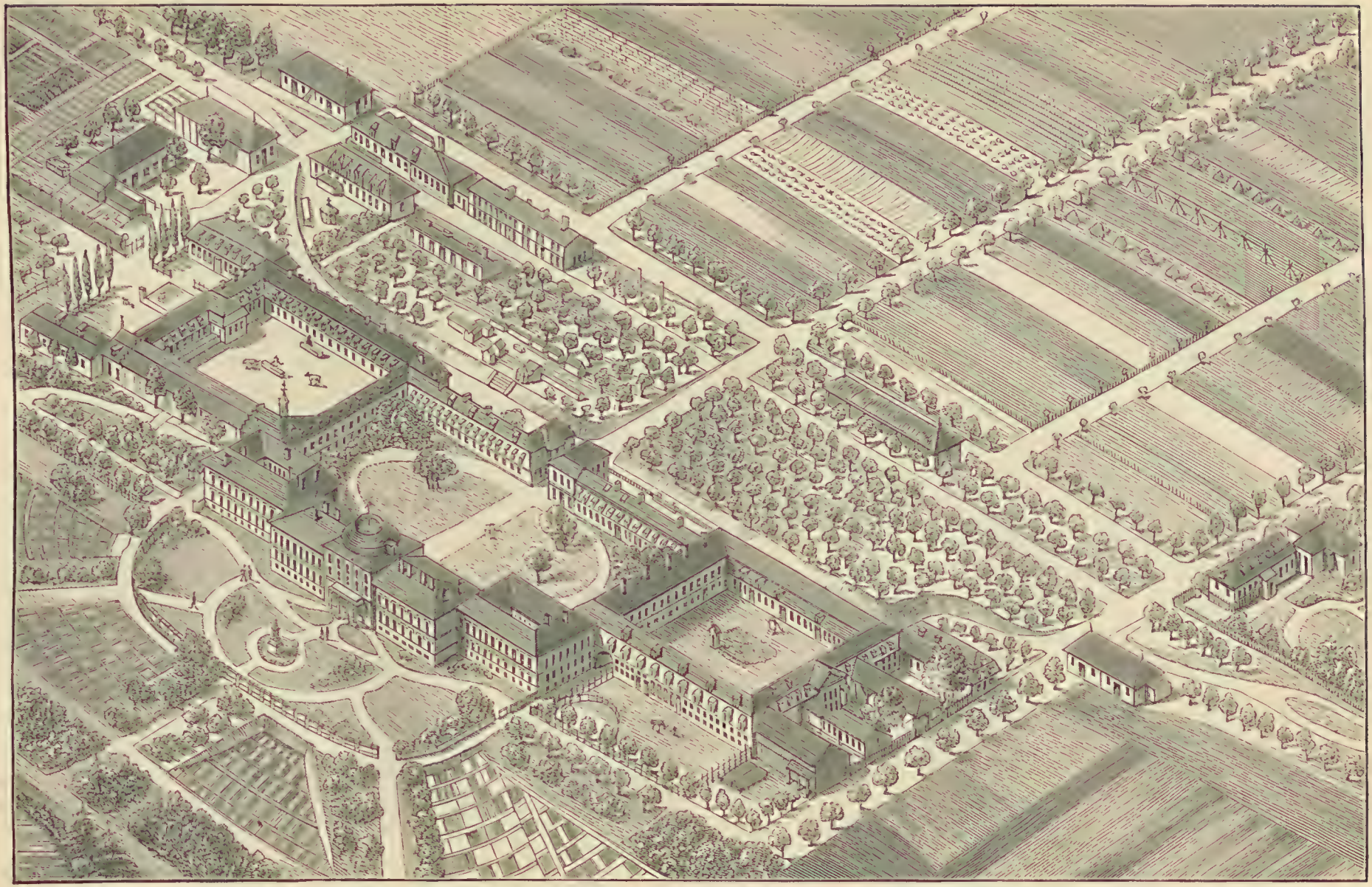
France.

Agricultural schools in France, as in Bohemia, are divided into three classes, which correspond with the high schools, academies, and schools of practical agriculture of the last-named country. The course of instruction in French schools has for its object the training of scientific and practical farmers, vine-growers, foresters, and gardeners, as is common to institutions in other countries. One of the principal, if not the most prominent institution of agriculture and forestry in France, is at Nancy, in the province of Lorraine, which town is situated on the frontier of what is now German territory, a portion of the province of Lorraine having been ceded to the Germans at the conclusion of the late Franco-Prussian war. The course of education in the Nancy school is of a very high order, which has warranted the Government of India in selecting it as the institution in France where to educate one section of the candidates who yearly present themselves for commissions in the Indian Department of State Forests.

Germany.

In no country of the world has the education of the agricultural classes in the principles which regulate the practice of husbandry been so generally studied and promoted as in Germany, and in no country is the standard of agricultural education so high, or the system so complete. There are no less than one hundred and fifty* agricultural educational establishments in the German States, which embrace colleges attached to universities, independent academies, schools of practical agriculture, and agricultural experiment stations. Each has its full complement of science teachers, who are engaged not alone in imparting information to students by means of lectures, but likewise in scientific investigation for the furtherance of the ends of agriculture. Among the more important of the agricultural institutions of Germany may be mentioned those of Berlin, Eldena, Giessen, Göttingen-Weende, Halle, Hohenheim, Jena, Plagwitz, Poppelsdorf, Tharand, and Weihenstephan, and, with few exceptions, all are supported either wholly or in part by the State. It would be impossible, however, in the space which has been allotted to this paper to give even an outline of the educational course of each separate institution; nor, indeed, would it be desirable to enter so minutely into the peculiarities which distinguish them one

* United States Department of Agriculture Report, 1868, page 144.



ROYAL ACADEMY OF AGRICULTURE AND FORESTRY, HOHENHEIM, WÜRTEMBERG

from another. It will suffice for the purposes of this article to give a detail description of one academy, of the kind which it has been advocated will be found best adapted to the requirements of this colony.

The Hohenheim Agricultural and Forest Academy.

The academy at Hohenheim is among the oldest and most celebrated of the agricultural schools of Germany. It was founded in 1818, and formally opened on the 20th November of the same year, under the directorship of Professor von Schwerz. The institution is situated about six English miles from Stuttgart, the capital of the kingdom of Würtemberg, and is located within the palace and royal domain, from which the college takes its name. The buildings were erected by Duke Charles of Würtemberg; and, after his death, they were repaired and appropriated to the use of the agricultural academy by King William. During the first year of the existence of the college the number of students did not exceed eight. This state of things, however, was not suffered long to continue, and as the institution became better known and grew in importance, so also did the students increase in number, until, at the present day, men of all nationalities enter the college, to benefit by the course of study which it affords.

The Course of Education.—The Hohenheim academy comprises three separate schools, viz., the higher agricultural school, the agricultural labor school, and the horticultural school; as well as a number of extraordinary courses.

The higher agricultural school, to which students eighteen years of age and upwards are admitted, embraces a complete course of instruction in all the branches of agriculture and forestry, and aims to prepare men to manage their own estates, or to become the stewards of large proprietors. Instruction is imparted principally by lectures and practical demonstration; and the course extends over a period of two years.

The agricultural labor school is distinct from the higher agricultural school or academy, and has for its object the training of men to fill positions as farm-bailiffs, or to manage small estates. The practical training of the students who enter this school is deemed to be the most important, and, consequently, they are compelled to work as laborers upon the farm, while their theoretical instruction is limited to an average of two hours daily. The course extends over a period of three years, and students are admitted at sixteen years of age.

The horticultural school, likewise, is an independent department. Students, before they are entitled to enter this school, are required to be

seventeen years old, and to have served an apprenticeship of three years to a gardener or vigneron, or to have completed the course of an agricultural labor school. The horticultural school aims, by a one year's course of theoretical and practical instruction, to perfect its students in the arts of landscape gardening and pomology.

In addition to these three schools, there are courses for shepherds and school-teachers; while instruction is afforded likewise in fruit-growing and the management of meadows.

The fruit-growers' course extends over a period of four to five weeks in the spring; and a few days in the summer to instruct the students in the arts of budding and grafting by practical exercises. Instruction in the management of meadows comprises a five weeks' course in the arts of meadow-culture and draining, and likewise field classes in surveying and the adjustment of boundaries. The course for shepherds occupies at the most four weeks, and commences generally in the month of February. Candidates for admission to this class must have completed their twentieth year, and have spent four years at least upon a sheep-farm. The course for school-teachers is limited to three weeks, and is held during the autumn vacation. The object is to diffuse a knowledge of the principles of agriculture among school-teachers, that they may apply them to illustrate their school tuition.

The Farm.—The farm contains 1000 morgen;* and the different branches should be considered separately, according as they embrace the farm proper, the experimental grounds, or the portions devoted to educational purposes. The farm proper is not supposed to represent a model farm in the fullest acceptation of that term. Too many matters have to be undertaken for educational ends to make the whole area serve as a model for others to follow. But it should and does serve as a model farm in respect to every improvement in agricultural practice, such as a rational system of rotation of crops, careful and thorough cultivation of the soil, proper treatment of manures, drainage, irrigation, &c. Of the whole area 835 morgen are devoted to the farm proper, the remainder to the requirements of the experimental farm, the botanical garden, &c. The farm proper is divided into eight fields, which vary in extent from 3 to 278 morgen. The live stock employed and kept upon the farm comprise 10 farm horses, 28 working oxen, 90 cows, heifers, and steers, and 1000 sheep.

The Botanical Garden.—This department contains an area of 15 morgen, and is situated on the plateau immediately in front of the

* One Würtemberg morgen contains 1·825 English acre.

palace. One part of the garden (3½ morgen) is devoted to the cultivation of industrial and other plants which are requisite for the illustration of the lectures on botany. The remaining space is planted with 300 forest trees.

The Experimental Farm is situated at the rear of the palace, and occupies an area of 31 morgen, the whole of which is divided in plots one-fourth of a morgen in extent. On these plots a great number of experiments are conducted to test the relative value of the different commercial and other manures, the advantages of deep over shallow tillage, the comparative effects of thin and thick seeding, of broadcast sowing and drilling, the fecundity of seeds from different localities, &c. These plots are also devoted to the raising of new and valuable seeds, and new varieties of well known plants, for distribution among farmers throughout the country.

The Vegetable Garden contains 3 morgen, and is devoted principally to the illustration of the lectures on vegetable growing, and to the experimental cultivation of new kinds of market-garden produce. In connexion with the vegetable garden are the flower garden and conservatories, which serve for the practical instruction of the students of the school of gardening.

The Vineyard is three-eighths of a morgen in extent. It serves principally as a medium of instruction in the lectures on vine-growing, by enabling the different kinds of grape to be exhibited, and the different methods of pruning and training to be demonstrated.

The Department of Applied Chemistry embraces a beet-sugar factory, brewery, distillery, starch factory, vinegar factory, fruit-drying establishment, &c. The object of these establishments is the demonstration of the lectures on agricultural technology. The sugar factory is furnished with apparatus for extracting syrup by pressure, and with the Dombaslechen maceration process. The factory is in operation in the months of November and December. The brewery is arranged for the manufacture of 50–70 eimers* of beer by different methods, in the months of January and February. In the distillery, one-half eimer of brandy is manufactured daily from potatoes, molasses, brewery refuse, &c. The appliances for the manufacture of starch and vinegar are used only for the purposes of demonstration. The different methods of drying fruit are carried on principally with the object of establishing in the country a rational use of fruit.

There is also an agricultural implement manufactory in connexion

* One Würtemberg eimer contains 64·7 English gallons.

with the college, to which the students have free access. The rearing and management of silkworms, and the preparation of flax, also form branches of instruction.

The Forest.—The forest lands attached to the institution comprise 6290 morgen in the Hohenheim district, and 5224 morgen in the Denkendorf district, to which must be added the nursery of exotic trees, which is 25 morgen in extent. The forest school at Hohenheim is as well provided with means for the practical instruction of the students as the agricultural school.

The Library contains over 4000 volumes on agriculture and forestry, and the sciences to which they are allied; and a sum is provided from year to year for the purchase of new and important works on these subjects.

The Museum contains collections of soils, manures, wools, minerals, woods, seeds, dried plants, wax models of fruits, models of machinery, implements, and farm tools; zoological specimens, physiological and pathological specimens, a collection of blacksmiths' tools, and shoes adapted both to the normal and different abnormal forms of the horse's hoof.

The Chemical Laboratory is a well-arranged and well-furnished department of the academy, and is placed under the able direction of Professor Dr. von Wolff. It contains, in addition to the necessary store rooms, four ample compartments, the two largest of which are used for the practical chemical work of the students; the third serves as a weighing-room, and contains, in addition to the balances, a collection of chemical apparatus; and the fourth forms the private laboratory of the professor of chemistry. The entire arrangements are in accordance with the requirements of an agricultural chemical laboratory. Instruction is given both in qualitative and quantitative analysis, and includes practice in the examination of minerals, acids, soils, manures, foods, milk, beer, water, ashes of plants, the conducting of the complete analysis of a soil, and instruction in the examination of substances of agricultural importance.

The cost of residence and instruction is as follows:—For students of the agricultural schools:—Foreigners, 300 gulden (£25) for the first year, and 200 gulden (£16 13s. 4d.) for the second year; and for natives, 100 gulden (£8 6s. 8d.) per annum. For students of the forest school:—Foreigners, 200 gulden (£16 13s. 4d.) per annum; and for natives, 60 gulden (£5) per annum.

There are in the academy twenty professors and assistants. The principle of the division of labor is carefully studied, so as to leave the

professors time for scientific investigation and experiment, a system which has been attended with the best results.

The following are the courses of study in the different schools attached to the Royal Academy of Agriculture and Forestry at Hohenheim :—

Agricultural Course.—1. General farm management, and the cultivation of ordinary farm crops. 2. The cultivation of special or extraordinary crops. 3. The management of meadows. 4. The cultivation of the vine, the hop, and the tobacco plant. 5. The culture of fruit-trees. 6. Kitchen gardening. 7. Breeding and general management of stock. 8. Horse-breeding. 9. Cattle-breeding. 10. Sheep-breeding. 11. The breeding and management of pigs and poultry. 12. Sericulture. 13. The keeping of bees. 14. Instruction in the business and general management of an estate. 15. Agricultural taxation. 16. Agricultural book-keeping. 17. Agricultural technology.

The lectures are demonstrated by practical classes on the farm, and in the laboratory, and also by field excursions. They are likewise illustrated by diagrams, and specimens from the collections in the museum.

Forestry Course.—1. Encyclopædia of forestry. 2. The connexion between forestry and agriculture. 3. Forest botany. 4. Management of forests. 5. Conservation of forests. 6. Economical use of forests and forest technology. 7. Duration of forests. 8. Forest taxation. 9. Study of State forestry. 10. Laws relating to forests. 11. Disposal of the products of the forest.

In connexion with this course are held practical classes in the different forests attached to the academy, the botanical garden, the collections of woods in the museum, and in the nursery of exotic trees.

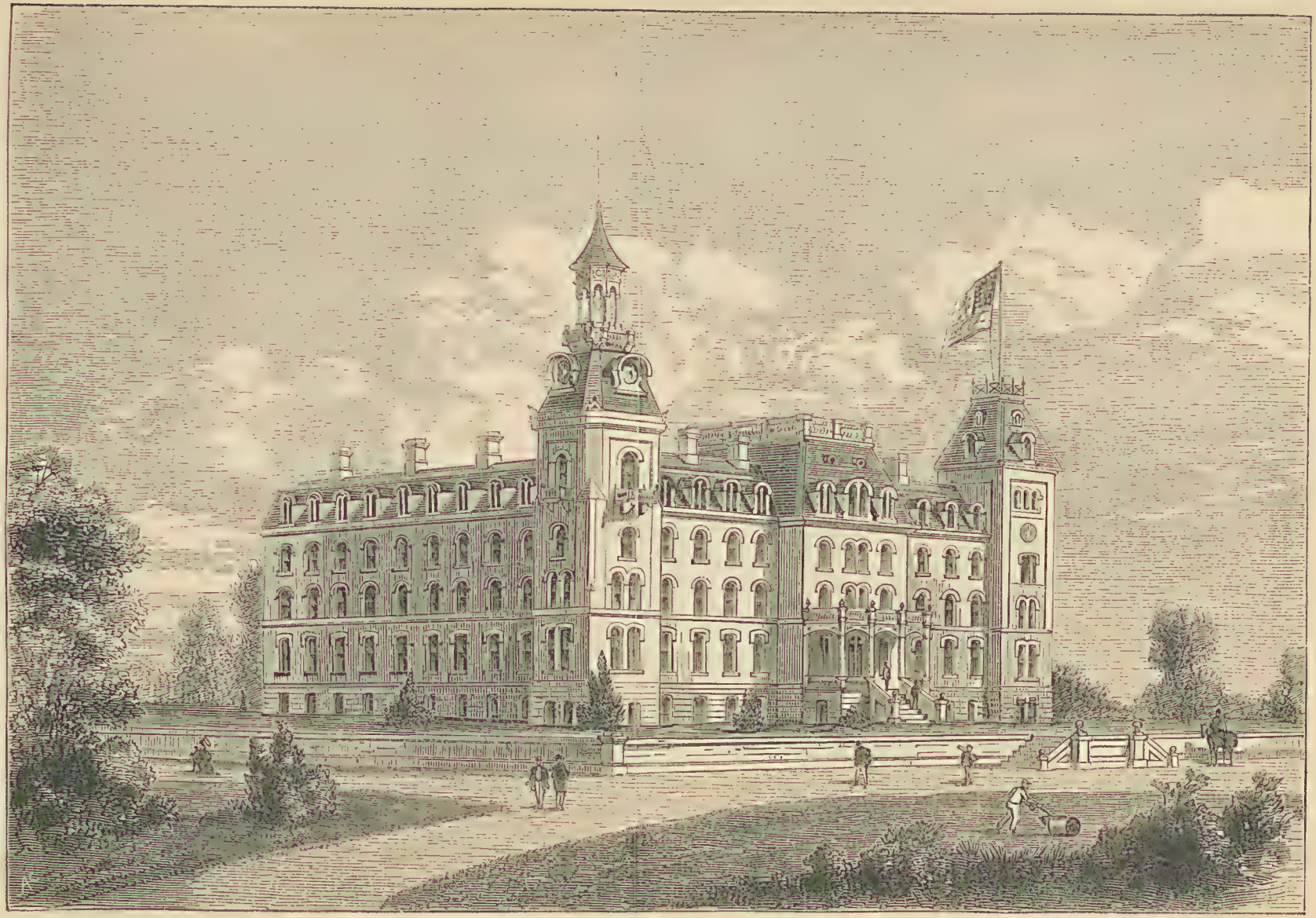
Accessory Studies.—1. Arithmetic and algebra. 2. Geometry. 3. Trigonometry. 4. Surveying and levelling. 5. Valuation of forests. 6. Mechanics and physics. 7. Chemistry, including inorganic, organic, and agricultural chemistry, and analysis. 8. Geology. 9. Elementary and special economic botany. 10. Vegetable physiology. 11. General zoology. 12. Special zoology of vertebrates for forest students. 13. Therapeutics. 14. National economy. 15. Jurisprudence for forest students. 16. Agricultural architecture. 17. Plan-drawing. There are also botanical and geological excursions, practical classes in veterinary practice, and field classes in surveying.

AGRICULTURAL EDUCATION IN THE UNITED STATES.

America affords us an instance of a country which, situated under conditions not dissimilar from those of Victoria, has developed, within a comparatively short period, a system of agricultural education that is yearly yielding richer and more lasting results, conferring more substantial benefits upon agricultural practice, and accelerating the development of the latent resources of the soil. America modelled her scheme after that which is existent in Germany, the several States of which country furnish the oldest and most perfect systems of agricultural education in Europe. The liberality of the land laws of the United States promoted the settlement of the country by persons from every quarter of the Old World, many of whom have been placed upon lands possessing far higher natural fertility, and situated in latitudes differing widely from those of their native homes, and, consequently, adapted for the development of a greater variety of crops, the cultivation of many of which the occupants, in a majority of cases, little understand, if at all. These, among other circumstances, led to the passing of an Act of Congress, entitled "An Act donating public lands to the several States and Territories which may provide Colleges for the benefit of agriculture and the mechanic arts," and the subsequent establishment of agricultural and industrial schools throughout the length and breadth of the country. This Act was passed 2nd July 1862, and under it an area of public land equal to thirty thousand acres for each senator and representative in Congress was granted to each State for the purposes abovementioned. This wise and far-seeing policy of the Americans has been the means of creating and perfecting a system of technical education in the United States which, though commenced barely twelve years ago, equals, if it does not excel, that of any European country. According to a statistical record which was published in January 1873, it appears that, at the end of 1872, when the Act had been only ten years in operation, thirty eight colleges had been established under its provisions in thirty-five different States of the Union, and that these institutions have been endowed with lands varying in extent from 90,000 acres in the case of the Delaware College, to 990,000 acres in the instance of Cornell. A complete statistical account of the agricultural and industrial colleges of America is given in an appendix. It will suffice for the purposes of this paper to give a description of one institution only.

Iowa State Agricultural College.

This institution is located at Ames, in the State of Iowa. It was founded under the provisions of the Act of Congress authorizing the



STATE AGRICULTURAL COLLEGE, STORY COUNTY, IOWA, UNITED STATES.

establishment of agricultural and mechanical colleges, and received an endowment of 240,000 acres. The building was commenced in 1865, and the college opened 21st October 1868.

The college makes no distinction of sex, color, or nationality, but admits all on equal terms. From its commencement it has been a marked success, especially in the features which distinguish it as an agricultural college. The farm contains 870 acres, and affords ample opportunity for practical work and the demonstration of the theories of the lecture-room ; and as the institution is not attached to any university, a good chance is afforded to test the wisdom or folly of such a separation. The labor system, which is one of the fundamental requirements of the college, has proved a marked success. The president says :— "From the experience of the past year, and convictions of a lifetime, I have full faith in the wisdom of the law that requires manual labor from every student, and I believe that such a requisition is indispensable to the prosperity of an industrial school. It gives needful exercise and bodily vigor, imparts skill in the use of tools, helps the student to defray his current expenses, applies science to practice, and promotes respect for honorable labor." The following descriptions of the objects of the institution and the courses of instruction afforded therein are taken from the Reports of the United States Department of Agriculture for the years 1865 and 1869. The illustration will give an idea of the extent of the building :—

"*Objects of the Institution.*—The Iowa State Agricultural College has for its object to associate a high state of intelligence with the practice of agriculture and the industrial or mechanic arts, and to seek to make use of this intelligence in developing the agricultural resources of the country and protecting its interests. It proposes to do this by several means :—

"1. As a purely educational institution its course of instruction is to include the entire range of natural sciences, but will embrace, more especially, a practical bearing upon the every-day duties of life, in order to make the student familiar with the things immediately around him, and with the powers of nature he employs, and with the material through the instrumentality of which, under the blessing of Providence, he lives, and moves, and has his being ; and since agriculture does this more than any other of the industrial arts, it follows that this should receive by far the highest degree of attention. The course of instruction is to be thorough, so that it will not only afford the student the *facts* of science, but will discipline his mind to habits of thought, and enable him fully to comprehend the abstract principles involved in the practical operations of life. In doing this, it is not deemed possible to educate every agriculturist, artisan, mechanic, and business-man in the State, but to send out a few students educated in the college course, that they, by the influence of precept and example, may infuse new life and intelligence into the several communities they may enter. A

single individual who is thoroughly educated in the principles and practice of an art followed by a community will often exert a more salutary influence upon the practice of this art by the community than would result from sending the *whole community* to a school of lower order than that which he attended. A single practical school of the highest order in Paris (the Ecole Polytechnique) during the last generation made France a nation celebrated alike for profound philosophers, great statesmen, able generals, and civil engineers. If one high school of practical character is established, subordinate schools affording the elementary education of the latter will follow in due time.

"2. *As a practical education*, the trustees of the Iowa Agricultural College have adopted the fundamental principle, that whatever is necessary for a man to have done, it is honorable for a man to do, and that the grades of honor attached to all labor are dependent upon the talent and fidelity exhibited in performing it. It is further considered essential, as a part of the student's education, that he be taught the practical application, in the field and laboratory, of the principles of his studies in the class-room; and manual labor is also necessary for the preservation of health, and the maintenance of the habits of industry. An incidental but not unimportant result of the operations of these principles is a reduction of the cost of tuition by the value of the labor, so that the college can take students at very low rates of admission.

"All students, without regard to pecuniary circumstances, are, therefore, obliged to perform manual labor as an essential part of the college education, and discipline, and training. In these respects consists a most essential difference between the idea associated with manual labor and that of all other attempts made heretofore to combine manual labor with study. Instead of the idea of poverty and want being associated with those who labor, that of laziness and worthlessness is associated with those who refuse to work efficiently, and the experience of established institutions has already, most assuredly, shown that no young man of whom there is any hope for future usefulness in life is insensible to the disgrace which thus attaches to the lazy, who will work only as they are watched, and cheat their fellow students by refusing to do the share of the labor assigned to them; and nothing is more conclusively settled than that those students who are most studious and industrious in class, work the most efficiently, and are the most trustworthy in the performance of their daily work.

"3. *As an experimental institution*, our college has an unbounded field for labor. The principles of agricultural science, which shall, ultimately, constitute the subject of instruction in its class-rooms, will be a prominent and important branch of it. The development of no other department will yield richer and more lasting results, or confer more substantial benefit upon agricultural practice, than this. Much time, however, is required to make thorough and reliable experiments —they will not pay at once. As well might the farmer expect to reap his crop the day he sows his grain. They will, however, ultimately pay a thousand-fold, as have the practical application of the sciences of electricity, heat, and optics, in the present day, paid for the half-century of apparently impractical, purely scientific investigations that led to the results now obtained through them.

"The design of this institution is different from all other educational institutions in the country, excepting one in Pennsylvania and one in Michigan, now in successful operation. By the union of labor and study they are both placed in their proper position, and thus only are exhibited in their true dignity. Here

they are taught to work together, and that separation is degrading to both. The student's mind and hands are first prepared to promote skill and success in the important and honorable occupation of cultivating the soil, but he will be almost equally fitted to fill with honor any other position in life. There is thus supplied a practical and equal education, so much needed by the great body of our farmers, and cheap enough to be embraced by all. The farmer who claims such an equal education for his son, feels an *imperative necessity* for an institution such as this. He sees that the son of a farmer who has been a four years' course at our old colleges returns with his eyes, and his thoughts, and the best of his mind directed *away* from the objects which worthily and usefully occupy his father and his brothers. He is useless and inferior in the sphere of his home ; he cannot labor ; he must go from home ; he is *driven* from it ; he can do nothing but enter a profession ; and in any profession he may enter, if he cannot make a conspicuous mark, he is a miserable being at best, and almost certain to fall into ruinous habits, and to become their victim ; and the unhappy and disappointed father loses not only the cost of his education, his own struggles and expended energy, but in three cases out of four *the son himself*. How different the case in circumstances which such an institution as ours is destined to establish ! The boy, in great part, aids to work out his own education. Instead of dragging on his father, he aids him ; instead of wasting his physical abilities, through want of exercise, he labors and develops them ; while his mind is being stored with both practical and refining knowledge, his hands are educated to expertness in a thousand operations, and his body to grace and strength. So plain is the need of this course of training, even to the dullest mind, and so plain is the method of establishing it, it is wonderful up to this day that such schools are only commencing in this country.

"The inquiry will, naturally, be made in regard to the cost of educating and sustaining a scholar in the college for one year. In the Farmers' High School of Pennsylvania the price for board, lodging, washing, fuel, and lights is fixed at 200 dollars, about £40 per annum. The cost in our institution would not exceed this sum, from which would be deducted the amount credited for labor on the farm. The tuition is made free by law to pupils from the State of Iowa."

The following is the course of study :—

"First year—*First term.*—Algebra, rhetoric, book-keeping. *Second term.*—Geometry, physiology and hygiene, English language and literature.

"Second year—*First term.*—Trigonometry, mensuration and surveying, general chemistry, botany, and vegetable physiology. *Second term.*—Mechanics, analytical chemistry, analytical geometry, zoology, practical agriculture, descriptive geometry.

"Third year—*First term.*—Analysis of soils, entomology, practical agriculture, botany, horticulture, forestry, mechanics of engineering, shades, shadows, and perspective, differential and integral calculus. *Second term.*—Chemical physics, geology and mineralogy, comparative anatomy and physiology, practical agriculture, mechanics of engineering, machine drawing.

"Fourth year—*First term.*—Agricultural chemistry, landscape gardening, rural architecture, history and principles of architecture, architectural drawing, carpentry

and masonry, political economy and logic. *Second term.*—Mental philosophy, constitutional law, veterinary science and art, civil engineering.

"For the first year the course of study is the same for both sexes. After this the course for ladies consists of studies adapted to meet their special wants. Ladies may, however, at their option, pursue any course of study in the college.

"All members of the college devote the afternoon to manual labor, spending two or three hours per day, according to the season, the weather, and the wants of the farm and workshop. The rate of payment varies from three to ten cents (1½d. to 5d.) per hour, according to the value of the service. The young ladies engage by rotation in all the different processes of the housekeeper's art.

"The expenses of students are reduced to the lowest figures possible. Board is furnished and washing done at actual cost. Students make a small deposit once a month for board, and settle at the end of the term. Incidental expenses are limited to the injury actually done to the furniture and rooms. Books are supplied by the institution at wholesale price."

Each representative district may send one student for every representative elected in such district to the popular branch of the legislature. Candidates for admission under this provision are subjected to examination before a certificate to enter the institution is granted.

The financial condition of the institution is in a healthy state. In addition to the Congressional grant of 240,000 acres, valued at 480,000 dollars, and leased to settlers, who pay annually in advance 8 per cent. interest on the estimated value, it has received from the State and from private sources donations amounting to 41,000 dollars. The building, which is valued at 237,000 dollars (£47,400), was erected at the cost of the State.

The first class that completed the four years' course of this college graduated in 1872. It contained 26 members, 17 of whom passed the agricultural, 8 the mechanical, and 1 the ladies' course.*

The number of stndents has increased from 192 in 1869 to 265 in 1872.

Thus, in as few words as possible, I have endeavored to give an outline of the systems of agricultural education existent in the more prominent of foreign countries, and to advocate a course for Victoria. I have omitted all reference to certain foreign lands, Austria, Belgium, and Hungary, among the number ; on the one hand, because I consider a more extensive review of this subject unnecessary, and, on the other, because the available space would not permit the pursuance of such a course. I trust, however, that I may have said sufficient to induce others to think, with me, that the time is come when this subject should

* United States Department of Agriculture Report, 1862, p. 360.

receive attention, and that delay can serve only to heap one defect upon another, and to render the task, when undertaken, more difficult to surmount. But before anything shall be done, it will be necessary, indeed indispensable, as I pointed out in my paper before referred to (page 87), to make ourselves thoroughly conversant with the systems pursued in at least the leading foreign countries. No course of education has undergone such rapid change, and in none have the alterations, which the advancement of scientific research have occasioned, been more extensive or more complete. The Americans are fully alive to this fact, and frequently send persons to examine and report on the changes made in the systems of Great Britain as well as those of Germany, France, and the other countries of continental Europe ; and by the exercise of such foresight, and the liberal application of public funds, they have built up a system, within a comparatively short period, which is not excelled, if equalled, in any other country. We will do well to follow in the steps of the United States.

APPENDIX.

STATISTICS for 1872 of the Industrial Institutions of the United States which have

Number of States having Industrial Institutions.	Location of the Institution.		Number of Industrial Institutions.	Name of the Institution.
	State.	Town.		
1	Alabama ..	Auburn ..	1	Agricultural and Mechanical College of Alabama ..
2	Arkansas ..	Fayetteville ..	2	Arkansas Industrial University .. ..
3	California ..	Oakland ..	3	University of California—Agricultural, Mining, and Mechanic Arts College
4	Connecticut ..	New Haven ..	4	Yale College—Sheffield Scientific School .. .. ..
5	Delaware ..	Newark ..	5	Delaware College .. ..
6	Florida	.. .. ..	6	Florida State Agricultural College* .. ..
7	Georgia	Athens .. / Dahlonega	7	University of Georgia — Georgia State College of Agriculture and the Mechanic Arts / North Georgia Agricultural College*
8	Illinois	Urbana ..	8	Illinois Industrial University .. ..
9	Indiana ..	La Fayette ..	9	Purdue University—Agricultural College* .. .. ..
10	Iowa	Ames	10	Iowa State Agricultural College .. ..
11	Kansas	Manhattan ..	11	Kansas State Agricultural College .. ..
12	Kentucky ..	Lexington ..	12	Kentucky University—Agricultural and Mechanical College
..	Louisiana ..	.. .. ..	..	(1. No industrial institution established in the State) ..
13	Maine	Orono	13	Maine State College of Agriculture and the Mechanic Arts
14	Maryland ..	Near Hyattsville	14	Maryland Agricultural College .. ..
15	Massachusetts	Boston	15	Massachusetts Institute of Technology .. ..
16	Massachusetts	Amherst ..	16	Massachusetts Agricultural College .. .. ..
17	Michigan ..	Lansing ..	17	Michigan State Agricultural College .. ..
18	Minnesota ..	Minneapolis ..	18	University of Minnesota — College of Agriculture .. / College of the Mechanic Arts
19	Mississippi	Oxford ..	19	University of Mississippi—College of Agriculture and the Mechanic Arts
20		Rodney	20	Alcorn University .. ..
21	Missouri	Columbia / Rolla ..	21	University of Missouri — Agricultural and Mechanical College / School of Mines and Metallurgy
22	Nebraska ..	Lincoln ..	22	University of Nebraska—College of Agriculture ..
..	Nevada ..	.. .. ..	..	(1. No industrial institution established in the State) ..
23	New Hampshire	Hanover ..	23	Dartmouth College—New Hampshire College of Agriculture and the Mechanic Arts
24	New Jersey ..	New Brunswick	24	Rutgers College—Scientific School .. ..
25	New York ..	Ithaca	25	Cornell University—Industrial Colleges .. .. ..
26	North Carolina	Chapel Hill ..	26	University of North Carolina—Agricultural and Mechanical College*
27	Ohio	Columbus ..	27	Ohio Agricultural and Mechanical College* .. ..
28	Oregon	Corvallis ..	28	Corvallis College—State Agricultural College of Oregon
29	Pennsylvania ..	Centre County	29	Agricultural College of Pennsylvania .. .. ..
30	Rhode Island ..	Providence ..	30	Brown University—Agricultural and Scientific Department
31	South Carolina	Orangeburgh ..	31	Claflin University—South Carolina Agricultural College and Mechanics' Institute
32	Tennessee ..	Knoxville ..	32	East Tennessee University—Tennessee Agricultural College
33	Texas	Bryan	33	Agricultural and Mechanical College of Texas* .. ..
34	Vermont ..	Burlington ..	34	University of Vermont and State Agricultural College ..
35	Virginia	Blacksburgh .. / Hampton ..	35	Virginia Agricultural and Mechanical College ..
36			36	Hampton Normal and Agricultural Institute ..
37	West Virginia	Morgantown ..	37	West Virginia University—Agricultural Department ..
38	Wisconsin ..	Madison ..	38	University of Wisconsin—College of Arts .. ..

* The College is not opened.

APPENDIX.

received the National Endowment of Land Scrip under the Act of 2nd July 1862.

Date of Acceptance of United States Scrip or Land by the State.	Acres in United States Scrip or Land granted by Congress to the State.	Securities in which the Fund derived from the United States Land Scrip is invested.	Value of the Agricultural and Mechanical College Buildings.	Value of the Philosophical and Chemical Apparatus of the Agricultural and Mechanical College.	Value of the Agricultural and Mechanical College Farm.
			$	$	$
31 Dec. 1863	240,000	In Alabama State bonds, at 8 per cent., paid semi-annually	100,000	2,000	2,000
31 Jan. 1867	150,000	The land-scrip has not yet been delivered to this State	5,000	..	12,000
13 Mar. 1864	150,000*	Only a very small quantity of the land has been sold	..	..	..
24 Dec. 1862	180,000	In Connecticut State bonds, at 6 per cent., paid semi-annually	225,000	25,000	No farm
7 Feb. 1867	90,000	In Delaware State bonds, at 6 per cent.	50,000	6,000	15,000
30 Jan. 1869	90,000	The land-scrip has not yet been delivered to this State	..	..	No farm
10 Mar. 1866	270,000	In Georgia State bonds, at 7 per cent.	130,000	10,000	No farm
.. ..	..		70,000	..	2,500
14 Feb. 1863	480,000	In Illinois State and County bonds	200,000	15,000	60,000
6 Mar. 1865	390,000	In United States 5-20 bonds, at 6 per cent. in gold ..	25,000	..	60,000
11 Sept. 1862	240,000*	In Iowa State bonds; only a small part of the land sold	237,000	7,000	10,584
3 Feb. 1863	90,000*	In School-district bonds and real estate; only a part of the land sold	31,000	..	3,000
27 Jan. 1863	330,000	In Kentucky State bonds, at 6 per cent.	120,000†	15,000	130,000
5 Mar. 1869	210,000	In Louisiana State bonds, at 6 per cent.; paid semi-annually	..	..	..
25 Mar. 1866	210,000	In Maine State bonds, at 6 per cent.; paid semi-annually	65,000	4,000	..
17 Feb. 1864	210,000	In Southern Relief bonds, by the authority of the State of Maryland	60,000	1,200	13,500
18 Apr. 1863	360,000	In farm and in United States bonds (and others), at 6 per cent. in gold	163,500	7,000	37,500
25 Feb. 1863	240,000*	In care of the State, which pays 7 per cent.	109,560	4,000	10,148
14 Feb. 1863	120,000*	In farm and in Missouri State bonds, and secured on lands sold	1,200	..	8,500
			..	..	..
30 Oct. 1866	210,000	In Mississippi State bonds, at 8 per cent. ..	..	..	1,100
			100,000	..	4,000
17 Mar. 1863	330,000*	Only a small quantity of the land has been sold for cash; interest paid on its valuation	75,000	10,000	60,000
			..	9,000	..
13 Feb. 1869	90,000*	None of the land has been sold	..	3,800	..
13 Feb. 1867	90,000*	.. ..	..	..	..
9 July 1863	150,000	In New Hampshire State bonds, at 6 per cent. ..	50,000	1,000	15,000
14 Apr. 1863	210,000	In New Jersey State bonds, at 6 per cent.	75,000	..	30,000
14 Mar. 1863	990,000	In New York State stocks and other securities ..	560,000†	12,000	40,000
24 Feb. 1866	270,000	In North Carolina State bonds	..	..	No farm
9 Feb. 1864	630,000	In the State treasury, on interest at 6 per cent.; paid semi-annually	..	..	112,000
9 Oct. 1862	90,000*	None of the land has been sold	6,000	1,000	5,000
1 Apr. 1863	780,000	In farm and Pennsylvanian State bonds, at 6 per cent.	300,000	4,000	59,136
27 Jan. 1863	120,000	In Rhode Island State bonds, at 6 per cent.	..	..	No farm
10 Dec. 1868	180,000	In South Carolina State bonds, at 6 per cent. ..	35,000†	..	9,000
18 Feb. 1868	300,000	In Tennessee State bonds, at 6 per cent.	53,000†	1,000	30,000
1 Nov. 1866	180,000	In Texas Frontier-defence bonds, at 7 per cent. in gold	..	..	..
1 Dec. 1862	150,000	In Vermont State bonds, at 6 per cent.	..	..	No farm
5 Feb. 1864	300,000	In Virginia State bonds, at 6 per cent. ..	14,000	..	20,740
			75,000	400	19,000
3 Oct. 1863	150,000	In United States bonds, at 6 per cent.	80,000†	4,000‡	..
2 Apr. 1863	240,000	In Wisconsin State bonds, at 7 per cent.	164,000†	10,000‡	..

* States which have received land within their own limits instead of scrip.
† Value of Buildings of the University and College, used in common.
‡ Value of Apparatus of the University and College, used in common.

APPENDIX.

STATISTICS for 1872 of the Industrial Institutions of the United States which have

Number of States having Industrial Institutions.	Location of the Institution.		Number of Industrial Institutions.	Name of the Institution.
	State.	Town.		
1	Alabama	Auburn	1	Agricultural and Mechanical College of Alabama
2	Arkansas	Fayetteville	2	Arkansas Industrial University
3	California	Oakland	3	University of California—Agricultural, Mining, and Mechanic Arts College
4	Connecticut	New Haven	4	Yale College—Sheffield Scientific School
5	Delaware	Newark	5	Delaware College
6	Florida		6	Florida State Agricultural College*
7	Georgia	Athens Dahlonega	7	University of Georgia {Georgia State College of Agriculture and the Mechanic Arts North Georgia Agricultural College*
8	Illinois	Urbana	8	Illinois Industrial University
9	Indiana	La Fayette	9	Purdue University—Agricultural College*
10	Iowa	Ames	10	Iowa State Agricultural College
11	Kansas	Manhattan	11	Kansas State Agricultural College
12	Kentucky	Lexington	12	Kentucky University—Agricultural and Mechanical College
	Louisiana			(1. No industrial institution established in the State.)
13	Maine	Orono	13	Maine State College of Agriculture and the Mechanic Arts
14	Maryland	Near Hyattsville	14	Maryland Agricultural College
15	Massachusetts	Boston	15	Massachusetts Institute of Technology
16		Amherst	16	Massachusetts Agricultural College
17	Michigan	Lansing	17	Michigan State Agricultural College
18	Minnesota	Minneapolis	18	University of Minnesota {College of Agriculture College of the Mechanic Arts
19	Mississippi	Oxford	19	University of Mississippi—College of Agriculture and the Mechanic Arts
		Rodney	20	Alcorn University
20	Missouri	Columbia Rollo	21	University of Missouri {Agricultural and Mechanical College School of Mines and Metallurgy
21	Nebraska	Lincoln	22	University of Nebraska—College of Agriculture
	Nevada			(2. No industrial institution established in the State.)
22	New Hampshire	Hanover	23	Dartmouth College—New Hampshire College of Agriculture and the Mechanic Arts
23	New Jersey	New Brunswick	24	Rutgers College—Scientific School
24	New York	Ithaca	25	Cornell University—Industrial Colleges
25	North Carolina	Chapel Hill	26	University of North Carolina—Agricultural and Mechanical College*
26	Ohio	Columbus	27	Ohio Agricultural and Mechanical College*
27	Oregon	Corvallis	28	Corvallis College—State Agricultural College of Oregon
28	Pennsylvania	Centre County	29	Agricultural College of Pennsylvania
29	Rhode Island	Providence	30	Brown University—Agricultural and Scientific Department
30	South Carolina	Orangeburgh	31	Claflin University—South Carolina Agricultural College and Mechanics' Institute
31	Tennessee	Knoxville	32	East Tennessee University—Tennessee Agricultural College
32	Texas	Bryan	33	Agricultural and Mechanical College of Texas*
33	Vermont	Burlington	34	University of Vermont and State Agricultural College
34	Virginia	Blacksburgh	35	Virginia Agricultural and Mechanical College
35		Hampton	36	Hampton Normal and Agricultural Institute
	West Virginia	Morgantown	37	West Virginia University—Agricultural Department
	Wisconsin	Madison	38	University of Wisconsin—College of Arts

* The College is not opened.

APPENDIX.

received the National Endowment of Land Scrip under the Act of 1872—*continued.*

Number of Acres in the Agricultural and Mechanical College Farm.	Number of Acres in Agricultural and Mechanical College Farm cultivated with Ploughed Crops.	Number of Volumes in the Agricultural and Mechanical College Library.	Name of the President of the Agricultural and Mechanical College and of the University.	Number of Professors and Assistants in the Agricultural and Mechanical College for the Collegiate Year.	Number of Students in the Agricultural and Mechanical College for the Collegiate Year.	Number of Students in the University and Agricultural and Mechanical College for the Collegiate Year.
200	..	1,000	Rev. J. T. Tichenor, D.D. ..	8	103	..
160	39	300	N. P. Gates, A.M.	3	..	183
200	..	500	Daniel C. Gilman, A.M. ..	11	..	..
No farm	..	10,000	Rev. Noah Porter, D.D., LL.D.	27	157	809
70	33	8,000	William H. Purnell, A.M. ..	10	..	..
No farm	..	..	Hon. Charles Beecher, President of Directors	..	..	..
No farm	..	*13,000	Rev. A. A. Lipscomb, D.D., Chancellor	11	126	250
70	..	..		2	..	..
623	214	8,103	JohnM.Gregory, LL.D., Regent	22	194	381
184	..	..	John Purdue, President of Trustees	..	..	..
870	160	3,000	A. S. Welch, LL.D.	17	..	..
415	100	3,000	Rev. Joseph Denison, D.D...	10	..	..
433	120	*20,000	John B.Bowman, A.M., Regent	13	..	..
370	17	1,500	Rev. Charles F. Allen, D.D.	11	..	..
270	102	..	Rev. Samuel Regester, D.D.	9	171	..
..	..	..	John D. Runkle, Ph.D., LL.D.	34	356	..
383	43	1,500	William S. Clark, Ph.D. ..	36	152	..
676	88	3,000	T. C. Abbott, LL.D.	13	131	..
143	30	..	William W. Folwell, M.A. ..	12	117	354
..	..	..				
110	20	..	Rev. John N. Waddell, D.D., Chancellor	13	..	..
200	..	..	Hon. H. R. Revels	..	..	112
600	60	200	Daniel Read, LL.D. ..	13	58	..
..	..	..		4	28	322
480	20	..	Allen R. Benton, LL.D., Chancellor	7	25	130
163	8	1,200	Rev. Asa D. Smith, D.D., LL.D.	9	23	408
99	72	10,000	Rev. William H. Campbell, D.D., LL.D.	11	50	194
200	127	*36,000	Andrew D. White, LL.D. ..	30	207	525
No farm	..	..	Rev. Solomon Pool, President of the University	..	..	..
320	..	300	Hon. Joseph Sullivant, Secretary of Trustees	..	..	..
36	24	400	B. L. Arnold, A.M.	5	22	165
600	..	800	Rev. James Calder, D.D. ..	10	150	..
No farm	..	*38,000	Rev. E. G. Robinson, D.D., LL.D.	9	27	204
116	25	..	Rev. A. Webster, D.D. ..	4	..	108
260	70	500	Rev. Thomas W. Humes, S.T.D.	10	38	228
800	..	..	Hon. H. Schiller Sjberg, Secretary of Trustees	..	..	..
No farm	..	*15,000	Matthew H. Buckham, A.M.	6	28	125
244	..	..	C. L. C. Minor, M.A.	4	113	..
125	66	200	General S. C. Armstrong ..	13	213	..
25	5	300	Rev. Alexander Martin, D.D.	6	22	159
234	..	*4,600	Rev. J. H. Twombly, D.D. ..	9	93	517

* Number of Volumes in the University and College, used in common.

A DESCRIPTION OF SOME VICTORIAN AND OTHER AUSTRALIAN GRASSES.

By Mr. W. H. Bacchus.

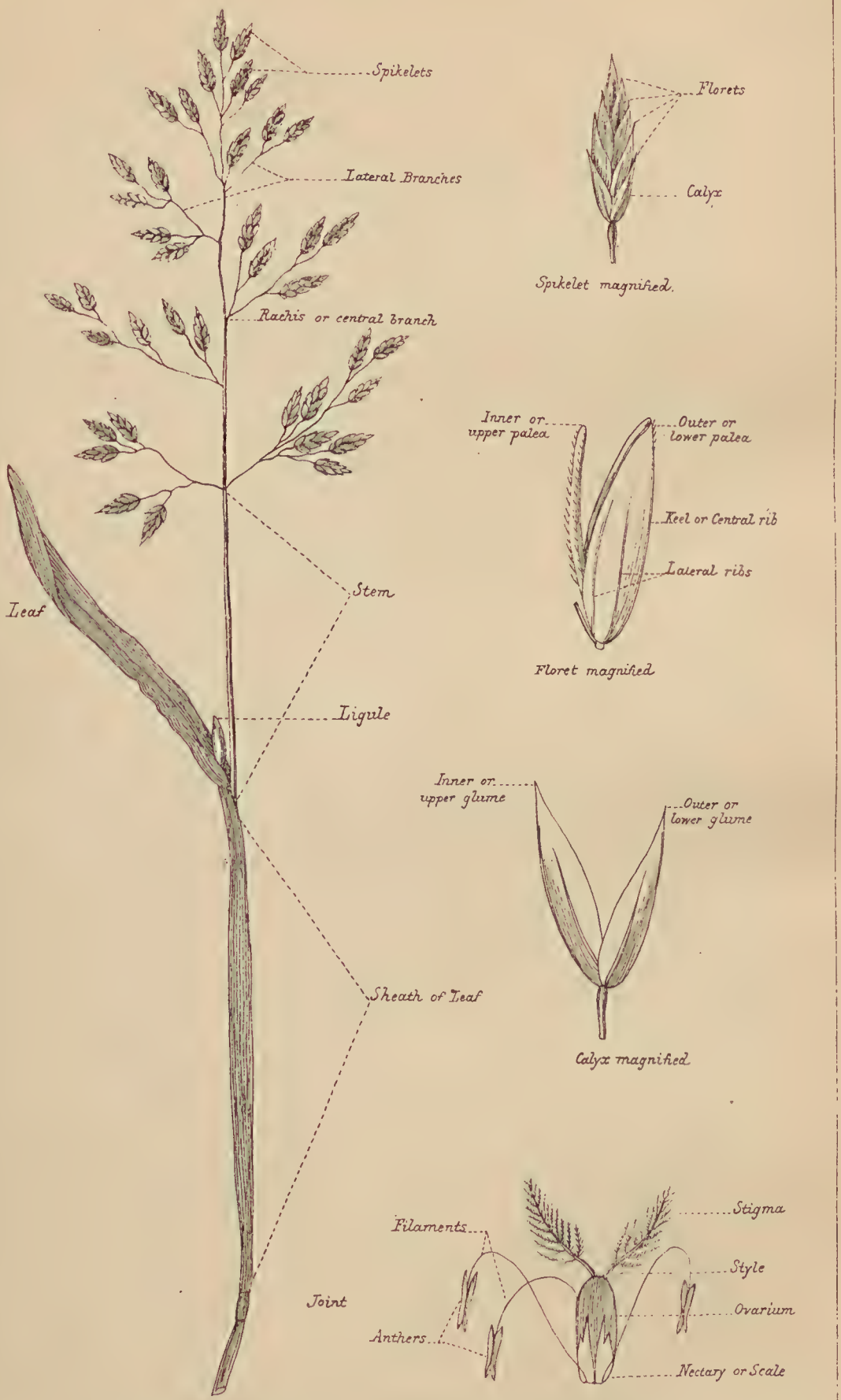
INTRODUCTORY.

Without much knowledge of scientific botany, I have made the study of grass and fodder plants an amusement, taken up at intervals, as time permitted.

To work among English and other European grasses was easy, as it is not difficult to procure in some book easily accessible information concerning their names and qualities; but nowhere could I obtain the same facilities when studying our native grasses. The only work published on the subject, and written in latin, was at the Public Library, and therefore of but little use. At last, however, I applied to the Government Botanist, to whom I am indebted for the botanical names of many of the grasses in my collection, and to his courtesy in assisting me to find others; but, owing to his time being so much occupied, there are several he could not work out. To such and some others I have given distinguishing names, which are italicised. The drawings—all of which, with the exception of Poa annua and Holcus borealis, are taken from the plants described—will, I think, enable any one who has given a little attention to the subject to make out the species described, on comparing them with the living or dried plants. To give minute descriptions of the grasses would have taken up more time than I could spare. The engraving of Poa annua dissected, taken from *Parnell's Grasses of Britain*, will perhaps be found useful for reference. In reply to my request for information, Baron von Mueller writes :—"The number of grasses observed by me in Victorian territory is about ninety. A full account of our grasses will appear probably in 1874, in the seventh volume of the universal work on Australian plants, which is published by the President of the Linnean Society and myself in London. Until that volume shall have appeared, the naming of each kind of grass will not be very easy, involving as it does great critical research and tedious comparisons with numerous grasses of other countries."

The habits and qualities of the indigenous and other grasses on my land at Peerewur and the neighborhood have been subjects of inquiry and interest to me for many years, and my observations have been recorded.

PLATE I.



Lith^d at the Dep^t of Lands & Agriculture by S.B. Bonney fr. from an engraved illustration in Parnell's "British Grasses."

Dissection of the common annual meadow grass.
(Poa annua.)

PLATE II.

Lith^d at the Dep^t of Lands & Agriculture by S.B. Bonney from Original Drawings by Misses A.F. Bacchus & G.M.B. Gilbert

Poa Australis tenax. *Poa Australis. humilis.*

PLATE III.

Lith.ª at the Dep.t of Lands & Agriculture by S.B. Bromley from Original Drawings by Misses A.E. Bacchus & G.M.B. Gilbert.

Festuca bromoides. *Danthonia bulbosa.*

PLATE IV.

Lith.d at the Dep.t of Lands & Agriculture by S.B. Bunney from Original Drawings by Misses A.E. Baldhus & G.M.B. Gilbert.

Festuca Hookeriana.

PLATE V.

Lith^d at the Dep^t of Lands & Agriculture by S B Bonney from Original Drawings by Misses A E Bacchus & G M B Gillett

Agrostis elatior. *Carex inversa.*

PLATE VI.

Lith.d at the Dep.t of Lands & Agriculture by S.B. Rooney from Original Drawings by Misses A.E. Bacchus & G.M.B. Gilbert.

Agrostis Solandri.

PLATE VII.

Lith.d at the Dep.t of Lands & Agriculture by S.B.Bonney from Original Drawings by Misses A.E.Bacchus & G.M.B.Gilbert.

Agrostis quadriseta

PLATE VIII.

Lith.d at the Dep.t of Lands & Agriculture by St. Bonney from Original Drawings by Misses A.E.B. Perkins & G.M.R. Gilbert.

Agrostis stolonifera. *Ehrharta stipoides.*

PLATE IX

Lith.d at the Dep.t of Lands & Agriculture by S.E. Bonney from Original Drawings by Misses A.E. Bacchus & G.M.B. Gilbert.

Aira cæspitosa

Aira coryophyllea.

PLATE X.

Lith.d at the Dep.t of Lands & Agriculture by S.B.Comey from Original Drawings by Misses A.E.Bacchus & G.M.B.Gilbert.

Danthonia pilosa. *Danthonia racemosa.*

PLATE XI.

Lith.d at the Dep.t of Lands & Agriculture by S.B. Bonney from Original Drawings by Misses A.E. Bacchus & G.M.R. Gilbert.

Andropogon Halepensis

PLATE XII.

Lith.d at the Dep.t of Lands & Agriculture by S.B.Bounsy from Original Drawings by Misses A.E.Bacchus & G.M.B.Gilbert.

Cynodon dactylon *Chloris truncata*

PLATE XIII.

Lith.d at the Dep.t of Lands & Agriculture by S.B. Birney from Original Drawings by Messrs A.F. Eaculus & G.M.B. Gilbert.

Lagurus ovatus *Polypogon monspeliensis.*

PLATE XIV.

Lith^d at the Dep^t of Lands & Agriculture by S.B. Bonney from Original Drawings by Misses A.F. Bacchus & G.M.B. Gilbert.

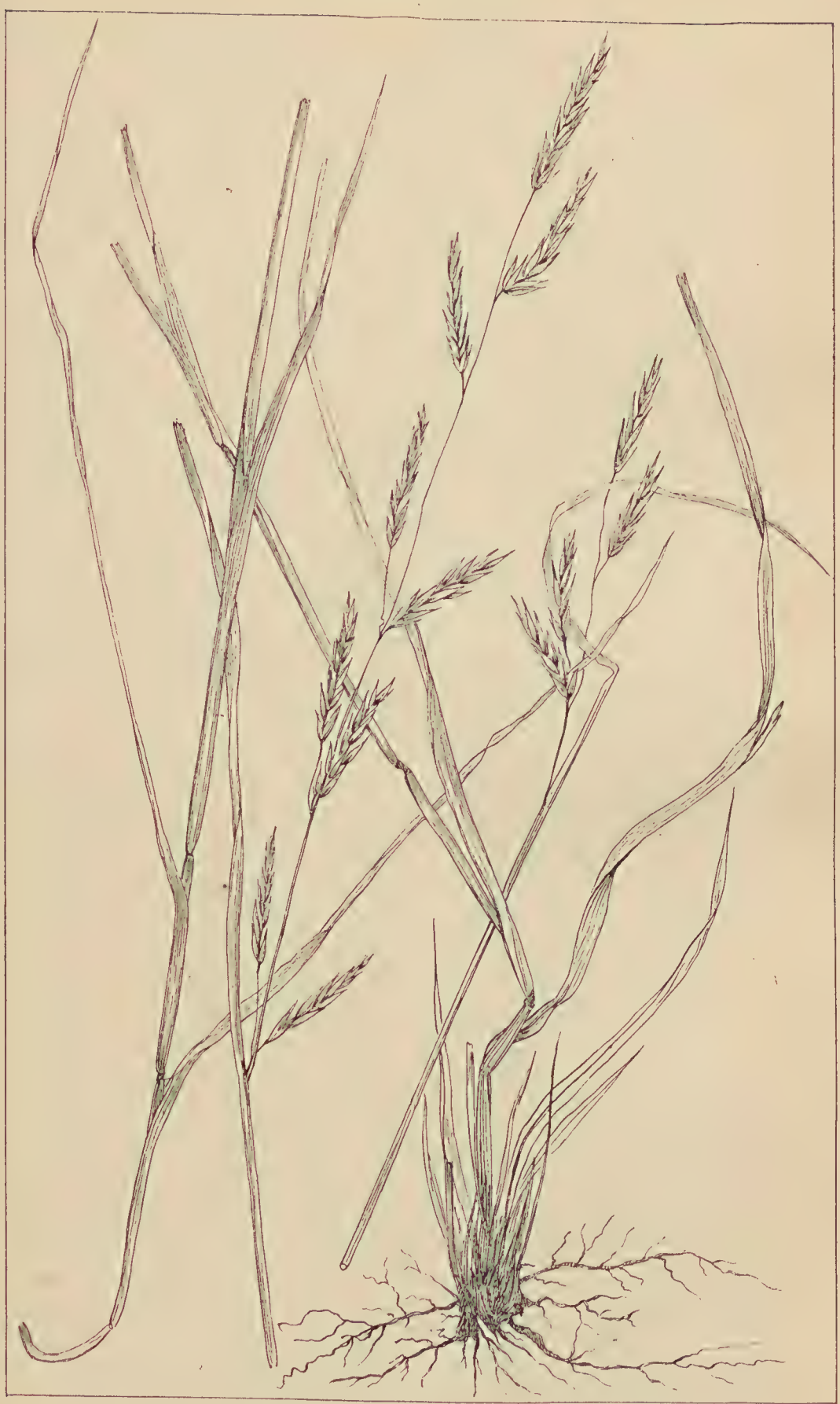
Panicum gallicrus.

PLATE XV.

Lith^d at the Dep^t of Lands & Agriculture by C.B. Bonney from Original Drawings by Misses A.K. Bacchus & G.M.B. Gilbert.

Hemarthria uncinata. *Cinna ovata.*

PLATE XVI.



Lith.d at the Dep.t of Lands & Agriculture by S.B.Burney from Original Drawings by Misses A.E.Baeckus & G.M.B.Gilbert.

Glyceria fluitans.

PLATE XVII.

Lith.d at the Dep.t of Lands & Agriculture by S.B.Bonney from Original Drawings by Misses A.E.Bacchus & G.M.B.Gilbert.

Dichelachne crinita.

PLATE XVIII.

Lith.d at the Dep.t of Lands & Agriculture, by S.B.Bonney from Original Drawings by Misses A.E.Baeckius & G.M.R.Gilbert

Rottboellia incurvata. *Stipa micrantha.* (Two varieties.)

PLATE XIX.

Lith.d at the Dep.t of Lands & Agriculture by S.B. Bonney from Original Drawings by Misses A.E. Bacchus & G.M.B. Gilbert.

Aristida vagans. *Stipa pubescens* *Stipa setacea.*

PLATE XX.

Lith.d at the Dept.of Lands & Agriculture by S.B.Bonney from Original Drawings by Messrs A.E.Bacchus & G.M.B.Gilbert.

Carex riparis.

" longifolia

Chætospora axillaris.

PLATE XXI.

Lith.d at the Dep.t of Lands & Agriculture by S.B.Bunney from Original Drawings by Misses A.E.Bacchus & G.M.B.Gilbert.

Hierochloa antarctica. *Hierochloa borealis.*

PLATE XXII.

Lith^d at the Dep^t of Lands & Agriculture by S.B. Bonney from Original Drawings by Misses A.E. Bacchus & G.M.B. Gilbert.

Festuca Billardierii.

Festuca dives.

(Four feet of stem omitted.)

PLATE XXIII.

Lith.d at the Dep.t of Lands & Agriculture by S.B.Bonney from Original Drawings by Misses A.E.Bacchus & G.M.B.Gilbert.

Pennisetum Italicum.

Vilfa elongata
Sporobolus elongatus.

PLATE XXIV.

Lith.d at the Dep.t of Lands & Agriculture by S.B.Bonney from Original Drawings by Misses A.E.Bacchus & G.M.B.Gilbert.

Bromus arenarius. *Bromus arvensis.*

PLATE XXV.

Lith.d at the Dep.t of Lands & Agriculture by S.P. Bonney from Original Drawings by Misses A.P. Bacchus & C.M.B. Gilbert.

Eriachne ovata. *A species of Eriachne.* *Festuca distichophylla.*

PLATE XXVI.

Lith.ᵈ at the Dep.ᵗ of Lands & Agriculture by S.B. Bonney from Original Drawings by Misses A.E. Barclay & G.M.B. Gilbert.

Imperata arundinacea. *Sporobolus pallidus.*

PLATE XXVII.

Lith.d at the Dep.t of Lands & Agriculture by S.B. Beaney from Original Drawings by Misses A.E. Bacchus & G.M.B. Gilbert.

Anthistiria Australis. *Paspalum dilatatum.*

PLATE XXVIII.

Lith.d at the Dep.t of Lands & Agriculture by S.E. Bonney from Original Drawings by Misses A.E. Bacchus & G.M.B. Gilbert.

Panicum hispidulum. *Isachne Australis.*

PLATE XXIX

Lith^d at the Dep^t of Lands & Agriculture by S.B.Bonney from Original Drawings by Miss A.E.Bacchus

Panicum ciliare. *Dactyloctenium Ægyptiacum.*

PLATE XXX.

Lith.d at the Dep.t of Lands & Agriculture by S.B. Bonney from Original Drawings by Miss A.F. Baeckius

A Poa of the section Eragostis. *Lappago racemosa.*

PLATE XXXI.

Lith.d at the Dep.t of Lands & Agriculture by S.B. Bonney from Original Drawings by Miss A.E. Bacchus

Eleusine distachyum. *Eleusine indica.*

PLATE XXXII.

Lith.d at the Dep.t of Lands & Agriculture by S.B.Bonney from Original Drawings by Miss A.E.Bacchus

Chloris divaricata *Paspalum distichum.*

The locality mentioned is in the Ballarat district, at the foot of Mount Warrenheip, from 1600 to 1800 feet above the sea-level, and, unless otherwise stated, my remarks about the merits and growth of grasses apply to them when growing in the land above mentioned.

This paper refers only to the indigenous grasses, or those which I think may be so, written somewhat hastily at periods of leisure during a rather busy time. In some instances my remarks may appear imperfect, or not to agree with the experience of others in the growth of the same grasses; but allowance must be made for a difference of soil, climate, and perhaps variety of species. It will give me pleasure if anything I have written should be the means of inducing further inquiry in this somewhat untrodden field. The subject is of importance to all, when the object is to increase the value of our grazing land by making it more productive, and in this way multiply the resources of the colony. The natural grasses may, perhaps, be usefully added to by other sorts to be introduced among them, or they may be injured. It is of consequence that it should be known what sorts will grow best with them.

From the *Treasury of Botany*, 1870—a work I would strongly recommend for general reference—some information has been taken, such as the names of the tribes to which some genera belong, and the number of species and habitats of certain grasses.

The same grass is often referred to differently. For instance, the kangaroo grass has been named by ten persons at least, and rejoices in as many names. This causes some confusion, but that cannot be helped. Several botanists may find the same grass, and each, not having heard of it before, calls it after what he pleases. In some instances it has cost me much time and trouble to get plants or seeds of a grass which I already had under another name. I would caution persons collecting specimens to keep them out of the reach of mice. These little creatures made sad havoc among my plants laid by for future reference. It is my intention at an early date to lodge with the Department of Agriculture, as far as practicable, a specimen of each grass which I have described. I shall be glad to receive seeds and plants of indigenous grasses not described in this paper from persons in the neighboring colonies, and I thank those who have already kindly assisted me in this manner.

W. H. BACCHUS.

Peerewur, Ballarat, 30th March 1874.

Growing on the highest and coldest situations of this continent, as at the heads of the Murray and Snowy Rivers, we find several grasses almost identical and of the same genera as those in Europe in similar localities ; for example, the Hierochloa antartica, or holy grass, with various species of Poa and Fescue, hardy perennials. Leaving these alpine regions, a less cold climate is indicated by the presence of such sorts as Danthonia, Anthistiria, Stipa, and Micralæna. In the middle and northern parts of Australia annual species become more numerous, and in the driest situations the grasses are largely supplemented by shrubs and herbs. The greatest variety grows in the northern parts, where numerous species of useful grasses, some of them of great beauty, flourish in all the luxuriance of a tropical climate. Here we meet with different species of Panicum, Andropogon, Lappago, Eriachne, Eragrostis, &c., in company with the ever-present kangaroo grass, with another variety, the very handsome Anthisthiria frondosa. Referring to the last-named grasses, I have heard it stated, on the authority of one of the pioneers in that part of South Australia called the Far North, that when he was travelling there with cattle, the pasturage was sometimes so luxuriant that the stock when lying down were quite hidden from view by the long grass. Dr. Schomburgk, in a paper on grasses and fodder plants recently read by him in Adelaide, stated—"The first surveyors coming to Yankalilla pitched their tents in an open valley or plain where they found the grass so luxuriant that it could be tied over a horse's back." In this valley at the present time but little grass is to be seen, rushes and such like plants occupying a large part of it. During 1838, in the neighborhood of Melbourne, I had some native grass cut for hay. It yielded at the rate of a ton to the acre, and was of excellent quality. Most of the native grasses, if not cut too late, make excellent hay.

About that time, in many places at Bacchus Marsh the grass was long enough to conceal a flock of sheep a few minutes after they were turned out of the yard. The immediate effect of such fine pasture was that the stock grazing on it were lying down half the day making fat. Two-tooth, or yearling merino wethers, often weighed when slaughtered from sixty to eighty pounds.

These instances are adduced to give some idea of the sort of natural meadows to which the pastoral pioneers of Victoria brought their flocks and herds.

The practice of grazing the same land throughout the year and over-stocking has had the effect of repressing and injuring the native herbage, whilst every encouragement has been given to the growth of sedges,

ferns, rushes, and other plants, which stock will not eat unless pressed by downright hunger. This practice must be reversed before our grass lands become again anything like what they once were.

Any native pasture in which kangaroo grass is plentiful can be kept in the best condition for quantity and quality of grass only by excluding stock of every description from the time that grass commences to throw out leaves in spring until it is in flower—about four months. It will then stand eight months of fair grazing, and support more stock in proportion than if it had been grazed all the year. If land be fed off on alternate years by sheep and cattle, there will be a greater variety of grasses. It is not desirable that sheep should be kept every year on the same land. Under that system, except in favored localities, the kangaroo grass and some other sorts gradually become scarce, or die out altogether.

Previous to the discovery of gold in these colonies, it was the practice to send sheep to, so called, winter runs—localities generally waterless in dry weather. Here they remained until the approach of summer, by which time the runs whence they came, having been rested, would be heavily grassed. In this way the native pastures were worked to the best advantage. Where climate and soil are favorable to the growth of any sort of grass, it is surprising in what a short time plants from a very small quantity of good seed will be spread over a large area; and it is to be regretted that some portion of the attention that is devoted to the cultivation of new varieties of flowers, such as pansies, verbenas, and the like, is not applied to raising some new varieties of grasses. Many of the native grasses produce plenty of seed, of which new sorts which appear to suit the locality might be collected. The profit from a little seed carried in the pocket and scattered in different places, a pinch here and there, would well repay all the trouble until larger quantities of seed were available. I have found by experience that the seeds of grasses do best when sown during the autumn—say in February and March. The soil for a short time after the first rains resembles a hotbed, and vegetation is then much quicker than in spring. I have noticed that where stock evince a liking for any sort of grass, and keep it so closely eaten down that it is prevented from flowering, the grass in question will soon disappear; and this, perhaps, is why so many of our best grasses have died out, and given place to others of inferior quality, with useless and noxious weeds.

There appears to be a considerable variation in the fat of stock from different localities, which is caused by the sort of food they consume.

During 1849 and 1850, when our surplus stock was boiled down for tallow, men who had worked for some time at a boiling-down establishment have told me that the locality from whence stock came could often be indicated by the appearance and consistency of the fat. Two lots of fat stock from different places may meet and travel together, equally well looked after, for several hundred miles; at the end of the journey one of the lots may have fallen off considerably in condition, the other hardly at all. "About my place"—a Queensland stockholder said to me—"the horses soon get fat, but lose condition quickly when on a journey, while horses from the Barcoo country scarcely fall off at all at the same work."

Some of the fattest cattle sold at the Melbourne yards come from Cooper's Creek, or the Barcoo, a journey of over one thousand miles. I recollect reading in the papers of the arrival in the Melbourne market of some exceptionally fat sheep, which had travelled a still longer distance. In the distant interior and Northern Australia, the land that turns off fat stock which will keep longest in the best condition has an increased value.

Tallow being composed of oleum and stearine, when the former is in excess, the fat is soft, and wastes readily; when stearine predominates, it is hard and durable. In localities where the vegetation consists to some extent of oil or sugar producing plants, the fat of the animals grazing on it will be soft, and liable to waste. They should not be sent for sale far from home; but stock from places where the vegetation is of a nature to produce an excess of stearine may be despatched to distant markets with a probability of arriving in good condition. Some of the native grasses which cause stearine to predominate in the fat of stock consuming them appear to be kangaroo grass, the Poas, Fescues, Danthonias, Eriachne, and others of the tribe Aveneæ; while among grasses which cause the fat of animals to be soft are species of the Panicum tribe, particularly those of which the seeds are largely consumed, and some sorts of Andropogon. I am fully aware that stock are also fattened on herbs and shrubs; but my paper has reference only to the indigenous grasses.

There are about 300 genera, and upwards of 4000 species of grasses. Nearly 400 species are indigenous in Australia.

The following is a list of the grasses of Australia enumerated by Robt. Brown in the edition dated 1821 of *Prodromus Floræ Novæ Hollandiæ et Insula Van Diemen;* to which, with some assistance from the Government Botanist, I have added the names of the tribes to which the genera belong :—

Sporobolus (Tribe, Agrostideæ)
- indicus
- elongatus
- pulchellus

Agrostis (Tribe, Agrostideæ)
- virginica
- parviflora
- crinita
- sciurea
- rara
- quadriseta
- cylindrica
- montana
- labeata
- ovata
- Billardierii
- æmula
- scabra
- plebeia
- decipiens

Perotis (Tribe, Agrostideæ)
- rara

Polypogon (Tribe, Agrostideæ)
- tenellus

Pentapogon (Tribe, Stipeæ)
- Billardierii

Aristida (Tribe, Stipeæ)
- vagans
- ramosa
- calycina
- stipoides
- hygrometrica

Streptachne (Tribe, Stipeæ)
- stipoides

Stipa (Tribe, Stipeæ)
- mollis
- semibarbata
- pubescens
- setacea
- elegantissima
- flavescens
- compressa
- micrantha

Amphipogon (Tribe, Pappophoreæ)
- laguroides
- turbinatus
- strictus
- debilis
- avenaceus

Diplopogon (Tribe, Pappophoreæ)
- setaceus

Anisopogon (Tribe, Aveneæ)
- avenaceus

Danthonia (Tribe, Aveneæ)
- longifolia
- pallida
- semiannularis
- pilosa
- racemosa
- setacea
- pauciflora
- paradoxa

Avena (Tribe, Aveneæ)
- nervosa

Bromus (Tribe, Festuceæ)
- Australis
- arenarius

Festuca (Tribe, Festuceæ)
- plebeia
- littoralis

Triticum (Tribe, Hordeæ)
- scabrum
  Festuca scabra, Labill.
- pectinatum
  Festuca pectinata, Labill.

Glyceria (Tribe, Festuceæ)
- fluitans
  Festuca fluitans, Labill.

Poa (Tribe, Festuceæ)
- Australis
- lævis
- plebeia
- affinis
- saxicola
- polymorpha
- interrupta
- diandra
- concinna
- leptostachya
- parviflora
- stenostachya
- pellucida
- elegans
- pubescens
- decipiens
- imbecilla
- tenella
- abortiva

Spica (Tribe, Festuceæ)
- disticophylla
- Uniola disticophylla, Labill.

Triodia (Tribe, Aveneæ)
- pungens
- procera
- parviflora
- microstachya
- irritans
- ambigua

Arundo (Tribe, Arundineæ)
- phragmites

Eriachne (Tribe, Aveneæ)
- rara
- squarrosa
- glauca
- avenacea
- ciliata
- pollescens
- macronata
- brevifolia
- obtusa
- capillaris

Pappophorum (Tribe, Pappophoreæ)
- nigricans
- palladum
- purpurescens
- gracilis

Triraphis (Tribe, Pappophoreæ)
- pungens
- mollis

Ectriosia (Tribe, Festuceæ)
- leporina
- spadicea

Eleusine (Tribe, Chloridéæ)
- radulans

Chloris (Tribe, Chlorideæ)
- ventricosa
- truncata
- divaricata
- pumilis

Cynodon (Tribe, Chlorideæ)
- dactylon
- Panicum dactylon, Labill.
- tenellum
- polystachyon

Cœlachne (Tribe, Festuceæ)
- pulchella

Milium (Tribe, Paniceæ)
- punctatum

Paspalum (Tribe, Paniceæ)
- polystachyum
- orbiculare
- pubescens
- littorale

Panicum (Tribe, Paniceæ)
- rarum
- phleoides
- myosuroides
- arcuatum
- strictum
- flavidum
- gracile
- argenteum
- holosericeum
- polyphyllum
- marginatum
- arroides
- pubescens
- foliosum
- pauciflorum
- pygmæum
- minutum
- bicolor
- uncinulatum
- effusum
- decompositum
- crus galli
- semialatum
- parviflorum
- striatum
- radiatum
- ciliare
- divaricatissimum
- villosum
- papposum
- tenuiflorum
- propinquum
- gibbosum
- paradoxum
- spinescens
- abortivum

Chamæraphis (Tribe, Paniceæ)
- hordeacea

Orthopogon (Tribe, Paniceæ)
- compositus
- æmulus

Orthopogon (Tribe, Paniceæ)
flaccidus
imbecillis
Pennisetum (Tribe, Paniceæ)
compressum
glaucum
Italicum
Panicum Italicum, L.
Cenchrus (Tribe, Paniceæ)
inflexus
Australis
Neurachne (Tribe, Paniceæ)
alopecuroides
Isachne (Tribe, Paniceæ)
Australis
Xerochloa (Tribe, Paniceæ)
imberbis
barbata
Thuarea (Tribe, Paniceæ)
latifolia
media
Spinifex (Tribe, Paniceæ)
longifolius
fragilis
sericeus
hursutus
Holcus (Tribe, Phalareæ)
parviflorus
gryllus
pallidus
fulvus
plumosus
elongatus
Anthistiria (Tribe, Andropogoneæ)
Australis
frondosa
Andropogon (Tribe, Andropogoneæ)
tenuis
striatus
contortus
triticeus
sericeus
affinis
pertusus
intermedius
procerus
exaltatus
lanatus
bombycinus
refractus
Andropogon (Tribe, Andropogoneæ)
fragilis
citreus
Saccharum (Tribe, Andropogoneæ)
irritans
fulvum
Imperata (Tribe, Andropogoneæ)
arundinacea
Lagurus cylindricus, L.
Dimeria (Tribe, Andropogoneæ)
acunaciformis
Ischæmum (Tribe, Andropogoneæ)
triticum
Australe
villosum
fragile
laxum
rottboelloides
Rottboellia (Tribe, Rottboellieæ)
exaltata
formosa
Ophiurus (Tribe, Rottboellieæ)
corymbosa
Lepturus (Tribe, Rottboellieæ)
repens
Hemarthria (Tribe, Rottboellieæ)
compressa
uncinata
Microchloa (Tribe, Chlorideæ)
setacea
zoysia
pungens
Agrostis matrella, Wild.
Hierochloa (Tribe, Phalareæ)
antartica
Tetrarrhena (Tribe, Oryzeæ)
disticophylla
acuminata
juncea
lævis
Micralæna (Tribe, Oryzeæ)
stipoides
Ehrharta stipoides, Labill.
Leersia (Tribe, Oryzeæ)
Australis
Patamophilla (Tribe, Oryzeæ)
parviflora
Leptaspis (Tribe, Oryzeæ)
Banksii

In addition to the foregoing, many more grasses have been found and described. An account of them will be given in the forthcoming 7th vol. of the *Flora Australiensis*:—

Although a large number of Australian grasses have been described, some of them are of little or no use for pastoral purposes. A writer in the *Queenslander*, last year, has observed that in many well grassed portions of Queensland a hundred varieties of grass can very often be collected within the space of a mile, but that not half a dozen of the whole can be termed fattening. It may be so in that colony; but in Victoria nearly all the grasses are nutritious, and the majority of them at some period of the year, for a longer or shorter time, are fattening. Herbs, and in some places shrubs, constitute a large part of the food of stock in Australian pastures. The fattening qualities of some of them equal those of the best graminaceous plants. It has occurred to me that, by the introduction of saline and bitter plants, such as salt bush, of which there are over 100 varieties, and Pentzia virgata, or sheep bush, localities where fluke is prevalent might be improved. I am supported in my opinion by the experience of Mr. Monckton Synnot, who has successfully cultivated the salt bush. He writes to me as follows:—

"In reply to your inquiries about the possibility of cultivating the salt bush, I can answer for the variety commonly known as the "Giant Salt Bush," which is not only easily cultivated, but when protected from stock grows rapidly into a handsome shrub. I grew a quantity at the Terricks, as shelter to the garden from wind, and found it to answer excellently. I also planted single bushes about the house, where it grew without trouble, and no amount of heat made the least difference to the young plants. I have no doubt that it might be advantageously grown, cut at certain times, and given with other food to cattle. It is quite possible it might be found valuable in parts of the country where fluke is prevalent.

"There are many varieties of the salt bush, all of which are rapidly disappearing. Where stock are run, the old plants die out, and the young ones are eaten off as fast as they come up."

Poa Australis. *Wiry grass.*—Perennial; in flower during November and December; a rather low-growing species, from nine inches to two feet high; common on the plains and elsewhere. Except when quite young, disliked by all kinds of stock. This grass seems to have no fattening qualities, but plenty of nutriment for stock to subsist on when forced by hunger to eat it. In this way it forms frequently their principal food during periods of drought.

Poa Australis. *Broad-leaved meadow grass.*—Perennial; flowers in December; average height at time of flowering three feet, growing

sometimes to six feet; leaves smooth, flat, and very long. Thrives on rich soil, in high, cold, and dry situations. A nice tender grass when young, but it soon grows into larger tussocks than any other grass we have. The herbage is of little value when suffered to grow old. If grazed or cut down close every year, it would afford a good supply of valuable winter food. This grass merits attention. I fancy this variety of Poa is that referred to by the Government Botanist as a favorite grass in New Zealand. In a letter to me, on the subject of difference in grasses, he writes—"Much of the value of grasses depends on their local development, or the production of a particularly favorable variety. I might exemplify this by an instance. We have along our river banks a rough, tufty kind of meadow grass (Poa Australis), which is so tough that the natives make nets and fishing lines of it; yet, in certain localities, this grass becomes far more tender in its foliage, and is then much sought after by cattle and horses; so much so, that this very grass was sent to me from New Zealand as one of their best indigenous fodder grasses."

Poa Australis *tenax*. *Narrow-leaved poa.*—(Plate ii.)—Perennial; found on the sides of watercourses and swamps; about three feet high; flowering in December. Of little value for grazing; but it may become of use as a fibre plant, and is probably the variety referred to by Baron von Mueller as the rough, tufty kind of meadow grass growing along river banks used by the natives for making fishing lines and nets. About a year ago I noticed what I believe to be a distinct variety of this grass, remarkable for the toughness of its leaves.

Poa Australis *decumbans*.—Perennial; flowering late in December. A small delicate grass, with weak slender stems, and thread-like leaves. I first noticed it here growing in some tussocks of dead rushes. It grows best in light moist soil, forming a kind of turf or cushion. Sheep graze upon it; but I cannot speak with any certainty of its merits as a pasture grass.

Poa Australis *humilis*.—(Plate ii.)—Perennial; grows one to two feet high; leaves narrow and succulent; flowering in December. It thrives on light dry soil, and appears to be a favorite with stock, and may possess superior merits for pasture.

Poa Brownii. Eragrostis Brownii.—Perennial; stems one to two feet high; common about Melbourne and Geelong, on both rich and poor soils, producing abundance of foliage. This grass has the great merit of keeping its verdure during the driest summers. A good fattening grass. Bears hard feeding. Produces plenty of seed. Is not indigenous about here, being a native of a warmer climate, as are all the varieties

of the section Eragrostis of the Poa tribe. Some plants obtained by me from near Melbourne, and planted here, thrive very well. It flourishes also in the comparatively cold climate of New Zealand. The Secretary of the Auckland Acclimatisation Society writes, under date 23rd September last year—"Eragrostis Brownii is abundantly naturalized about the Bay of Islands, and is proving itself a valuable grass."

Poa nodosa, P. tenella, P. Chiniensis, and P. parviflora are found in New South Wales and Queensland. I know nothing of their value for pasture. They are very handsome grasses.

All the Poas seed freely.

Bromus arenarius.—(Plate xxiv.)—Annual; general height about two feet. I have not seen it in Victoria. Many years ago, in the Bathurst district of New South Wales, I saw a grass similar to the specimen from which the drawing is taken, and which I was told was a valuable grass. Two species are enumerated by R. Brown—Bromus arenarius and B. Australis.

The grass I have referred to may be one of them.

Bromus Australis has been much commended for its fattening and general feeding qualities by stockholders in New South Wales and Queensland.

Bromus *arvensis.*—(Plate xxiv.)—This species is found about here, and flowers in November. It is distinct from Bromus mollis, which is an inferior variety, and resembles in appearance and merits the B. arvensis, as described by Sinclair. It affords an early bite in the spring, is eaten by stock equally with other grasses, and exhausts the soil but little. The seed falls when ripe, and vegetates quickly among the root leaves of the permanent grasses.

Festuca dives. *Native oat grass.*—(Plate xxii.)—Perennial; in flower here during December; general height up to six feet, but it sometimes attains to more than twice that height; grows on the Australian Alps and the mountainous country east of Melbourne. Its unusual size gives it a very striking appearance. Although a large plant, every portion of the leaves and stem are succulent and tender, and it does not grow in coarse tussocks. I mistook the first plant I obtained for one of F. Hookeriana, and by division of its roots soon obtained several plants. On rich land it ought to yield a very large crop of hay, for which it is better adapted than for grazing. I venture to predict that this grass, when better known and brought into cultivation, will be prized highly, and found to be one of the best fodder grasses we have. The seed, I understand, can be obtained in the local-

ities where it grows. Some that was sent to me was sown last October, but did not come up. As it appeared to be good, I attribute its failure to the very hot weather during November and December.

Festuca Hookeriana. *Georgies Fescue.*—(Plate iv.)—Perennial; found in the higher and colder parts of Victoria, New South Wales, and Tasmania; in flower during December. It grows from two to four feet high, is excellent as a pasture grass, and has a handsome appearance when in blossom.

Festuca Billardierii.—(Plate xxii.)—Perennial; about two feet high; in flower during December; does not appear to perfect its seed well; common in this colony; produces plenty of tender foliage; not much affected by a dry summer or easily injured by overstocking. I notice what appears to be a larger variety of this grass, which grows singly, not in patches like that first described.

Festuca disticophylla. *Native couch grass.*—(Plate xxv.)—Perennial; found in most parts of the colony; usual height six inches to a foot. It will be easily recognized on reference to the drawing. This grass does not grow about here, nor does it appear to be of much value to the farmer. My plants dried off.

Festuca bromoides. Silver grass.—(Plate iii.)—Annual; flowering in November. Baron von Mueller appears to consider that this very common and well known grass may be indigenous; but I think it is imported. Usual height one to two feet; a nice tender grass when young; vegetates early in the season. This grass is useful in keeping up the supply until others of a later growth come in, when it dries up. In cultivated land it becomes a troublesome weed. There is a distinct variety of this grass, distinguished by its having a larger bunch of leaves, the panicle being longer and denser.

Festuca littoralis.—A coarse description of grass, found along the sea shore and the mouths of rivers. Of no value to the farmer.

Glyceria fluitans. Manna grass.—(Plate xvi.)—Perennial; flowering in December; common in moist situations; grows from two to four feet high. This grass flourishes in rich soil and swampy ground, often extending far into the water, floating in luxuriant growth on the surface. Cattle and horses are fond of it, even when partially dry. The seeds, when ripe, are soon eaten by birds, and frequently their place is supplied by the egg of an insect, which is deposited in the space from which the seed had been taken. "This grass is cultivated in many parts of Germany for the sale of its seeds, which are esteemed a delicacy in soups and gruels. When ground into meal they make bread, very little inferior to that from wheat."—*Schreber.* Fish are very

fond of the seeds. There are several varieties of this grass found in Australia. Baron von Mueller sent me a specimen of a fine-looking variety, G. Fordiana, from the Darling.

Agrostis quadriseta. *Reed grass.*—(Plate vii.)—Perennial; two to four feet high; apparently producing plenty of seed in January, but perhaps few fertile seeds; found throughout Australia. This is an excellent grass, which might be improved by cultivation. There is a dwarf variety, with a more spreading habit of growth and a greater number of radicle leaves. Both sorts do not wither up in summer and grow during winter.

Agrostis Solandri. *Winter grass.*—(Plate vi.)—Perennial; also annual, flowering during October and November. This grass is found in all parts of Australia. Usual height one to two feet. There are several varieties. It is the first grass to spring after summer rains, and keeps up a supply of nutritive herbage during winter; seeds freely. I consider this to be a very useful winter grass. When summer comes it dries up, making room for other sorts. The drawing shows the panicle when just coming into flower and when the seeds are formed.

Agrostis parviflora.—Perennial; about eighteen inches high; flowering in January and later. I fancied this was not a native grass, but now I have no doubt of its being indigenous. It vegetates rather late, making small patches of close turf; is fed off in common with other grasses.

Agrostis *elatior. Taller Agrostis.*—(Plate v.)—Perennial; grows to three feet high; panicle resembles that of parviflora, but has larger florets; it also grows much higher and more erect; only found in moist localities; not plentiful. This grass is not so much eaten by stock as I had expected from its inviting appearance.

Agrostis stolonifera. *Creeping Bent grass*, Fiorin.—(Plate viii.)—Has a creeping and climbing habit of growth. I have noticed it in moist places, with other natural grasses, for more than twenty years. It resembles in description, qualities, and habits A. stolonifera as described by Sinclair. The chief advantage of this grass in permanent pasture is its late growth. It remains in a degree inactive till other grasses have attained to perfection, and when their productive powers become exhausted those of Fiorin and its varieties begin. The last three grasses seed well. The two last flower from January to March. Agrostis æmula is one of the pasture grasses of Tasmania.

Aira cæspitosa. Tufted hair grass.—(Plate ix.)—Perennial; a tall-growing tussocky grass. The specimen from which the drawing is taken is from Tasmania, in which colony I think it was pointed out to me as an

inferior grass so long ago as 1838. It does not grow about here. In the old country this grass is considered of no value for grazing. There is a distinct species or variety in Gippsland, which I believe makes a fair pasture grass.

Aira caryophyllea.—(Plate ix.)—Annual; about a foot high; flowers during December, and sheds as soon as they ripen a profusion of minute dark-colored seeds. Having noticed for many years past a few plants here and there, this has been placed among my native grasses, from which at present I am unwilling to eliminate it. Baron von Mueller is of opinion that it is not indigenous. Stock do not appear to be fond of it, and scarcely touch it.

Lagurus ovatus. Hare's-tail grass.—(Plate xiii.)—Annual; a foot to eighteen inches high. I considered I had got something new on finding a single plant of this grass. On comparison with others, it appeared to resemble the genus Imperata as described by R. Brown, but I found out the name of the interesting stranger on seeing the drawing of it in Parnell's work, where this grass is described as a native of the south of Europe and some parts of Asia. It might possibly be indigenous. Should any person who may notice the drawing have seen grass closely resembling it on uncultivated lands, I shall be thankful to receive a plant. It may be known by the soft, light appearance of the spike or flower-head.

Stipa setacea.—(Plate xix.)—Annual; one to three feet high; flowers in November; common in dry situations. By reason of its early growth of nice tender herbage, which stock are fond of, it constitutes a useful part of the supply of early annual grasses; but the awned seeds, which it so abundantly produces, are very injurious to wool, and often fatal to sheep. I once lost 800 out of 2000 lambs by placing them on a part of the run which had been rested for some time, where this grass abounded, and was just beginning to shed its seeds, which penetrated the skin in hundreds, and but for being able to get them shorn at once, I believe nearly all the lambs would have died.

Stipa micrantha.—(Plate xviii.)—There are two varieties of this grass, both of which I have noticed between here and the coast. Their seeds do not appear to be injurious. A drawing of each is given. They are closely grazed by stock.

Stipa pubescens.—(Plate xix.)—Annual; resembles in many respects S. setacea, except that is is a larger-growing grass. The seeds are damaging to wool.

Stipa ramosissima.—Annual; three feet high, and more; a fine looking grass, with plenty of foliage; the seeds are numerous and injurious to wool.

Dichelachne crinita.—(Plate xvii.)—Perennial; flowering in December, and seeding freely. In favorable, that is rather dry situations, this grass grows over three feet high, standing the heat well. It is an excellent pasture grass, thrives well with kangaroo grass, and flowers about the same time. The two make excellent hay, or, if grazed, a very fattening mixture.

Aristida vagans.—(Plate xix.)—Annual; found in the warmer parts of Victoria; one of the early annual grasses. The drawing is given for comparison with the Stipas.

Arundo phragmites. Common reed.—This well known plant, growing sometimes to over fifteen feet high, is the tallest of our grasses, and at times a very useful one too for grazing purposes, as those who have known the reed beds in Riverina and elsewhere can testify. The reed is turned to account in so many ways, or rather used to be, that I copy some of them from *Withering's British Plants*:—"In Sweden the country people use the panicle to dye woollen cloth green. For thatching, reeds are more durable than straw. Garden screens are made of them, and they make a good foundation for plaster floors; they are also in demand by brickmakers. Till the introduction (in the seventh century) of pens made from quills of birds, they were in general use for writing. They also occasionally serve for arrows. The young shoots, cut from the root, when not exposed to the light, make an excellent pickle. The nest of the sedge warbler is generally found suspended between the stems, at a small height from the ground. Entomologists may sometimes find a considerable variety of insects on the panicles, where they resort for food or shelter." In situations where the reed grows here, some of the most valuable pasture grasses, native and exotic, will grow also.

Hierochloa antartica. Holy grass.—(Plate xxi.)—Perennial; flowering in October and November. An Alpine grass, with strong creeping roots, growing in the highest and coldest parts of this colony and Tasmania. There are two species known to me, one growing to near three feet high with a long loose panicle, the other a lower-growing grass with its panicle more compressed. There is also a still smaller species, H. Alpina. I am aware that stock eat this grass, but know nothing of its merits for grazing. The taller-growing sort, from the Australian Alps, near the head of the Snowy River, is shown in the drawing. By its side is a drawing of H. borealis, or the northern holy grass of Europe, taken from Sinclair's work on the Woburn grasses. The name holy grass has its origin in the custom in some parts of Europe of scattering this grass before the doors of churches on certain holidays, when its perfume is given off on being trodden upon. On the authority

of the *English Flora* 1824, a similar custom exists in England:—"The Acorus calamus has time out of mind been employed in the cathedral and streets of Norwich on Mayor's day, in the same way as the Hierochloa is used in Prussia at high festivals."

Danthonia.—This genus of grasses includes a large number of useful species for grazing, most of them indigenous to South Africa and Australia.

Danthonia *bulbosa*.—(Plate iii.)—Perennial. I was unable to ascertain the name of this grass, so have called it bulbosa from its distinct bulbous root. It is probably D. nervosa; grows to over three feet high, produces seed fairly, flowers during January, and is frequently met with in the colony. It grows best in moist situations, and well among other grasses, sending up plenty of bright-green leaves during summer and autumn. It is hardy, and possesses superior nutritive qualities.

Danthonia pilosa.—(Plate x.)—Perennial; grows to over two feet high; frequent in Victoria and New South Wales; a good seed-producer; flowers early in December. It is a hardy and good pasture grass, but does not stand the summer heat well.

Danthonia racemosa. *Bunch danthonia*.—(Plate x.)—Perennial; usual height of stems one to two feet; flowers in December, sometimes earlier; a good seed-bearer. This is the principal grass of which a large portion of Victorian pastures are composed. It is very hardy, and bears overstocking better than any other native grass known to me. If attended to, it would make a close turf. Its nutritive properties are considerable. It appears to thrive with rye-grass and clover, which many native grasses will not do.

Danthonia semibarbata.—Perennial; one to two and a half feet high; seeds numerous. A hardy, useful pasture grass; grows well on poor soil. Scarce about here; it does better in a warmer climate.

Triodia.—Six species are enumerated by R. Brown. Most of the grasses which belong to the tribe Aveneæ, as does this genus, are useful for hay and pasture. I have seen Triodia pungens and T. irritans, but have no experience of their qualities.

Anthistiria Australis, A. ciliata. Kangaroo grass.—(Plate xxvii.)—Perennial; average height under three feet, on rich unstocked land much higher, with strong penetrating fibrous roots; in flower during December. This grass is found in all parts of Australia. It forms generally but few perfect seeds, and these do not germinate readily. Some plants are much better seed-bearers than others. It is the finest and most useful of all the indigenous grasses. Here it commences to vegetate early in November, when all stock should be taken away

until it is in flower. From then until winter it proves an excellent fattening grass. It keeps green during the summer, but turns a little brown in autumn, when its nutritive qualities are at the highest. In the early days of the colony I have ridden the same horse twenty to forty miles daily, on a journey of several hundred miles, turning him out to graze on pasture of which this grass formed the principal part, and the horse kept his condition. With a sufficiency of this grass, a little turned by the sun, the working powers of horses and cattle can be taxed to the utmost. They keep in better condition doing hard work on this than on any other description of native forage. If closely grazed by sheep or cattle (the former in particular) all the year round, it soon dies out. Other varieties of this valuable grass might be obtained by cultivation. The kangaroo grass, so long thought to be exclusively Australian, has been proved by Baron von Mueller to be identical with the Anthistiria ciliata of Linnæus; it is known throughout Africa, and the warmer parts of Asia, as far east as Japan.

Anthistiria frondosa.—Perennial; a very handsome grass, growing to the same size, and possessing similar qualities, as the A. Australis. I have not seen this species in Victoria. My specimens are from the Northern Territory of South Australia, and from Queensland.

Andropogon.—Steudel enumerates four hundred and fifty-eight species of this extensive genus of grasses, and fifteen are described by R. Brown. My collection contains about twelve species from Northern and Western Australia. Some interesting matter relating to this genus will be found in the *Treasury of Botany*.

Andropogon haleppensis.—(Plate xi.)—Perennial; a tall-growing grass; indigenous to the northern parts of New South Wales and Queensland. There are a few plants of it in my collection, cultivated for test purposes. I have never seen it growing among indigenous grasses. It is valuable for both hay and pasture.

Imperata arundinacea.—(Plate xxvi.)—Annual; two to four feet high. This grass appears to be closely allied to the genus Saccharum, to which belongs the S. officinarum or sugar-cane of commerce. I have never seen this grass in Victoria, but have received plants from Queensland and the Northern Territory of South Australia. It has a remarkable appearance, with its large spikes showing much of a substance attached to the seeds resembling thistle down. In places where it thrives, I believe this grass may be useful for hay and pasture. It is hardy, and produces seed freely. If our Government would suggest that small patches of rare indigenous and other grasses should be cultivated in those Botanic Gardens which receive State aid, with the object of distributing packets

of seed for test purposes, many valuable sorts of grass might be introduced to suitable localities. There are a large variety of native grasses which require testing by cultivating them in different parts. Here the State might take the initiative ; the system would be carried on afterwards for profit by private enterprise. Baron von Mueller writes of this grass:—"Imperata arundinacea you might regard structurally as a miniature sugar-cane; it extends naturally from Tasmania to the Mediterranean Sea."

Cynodon dactylon. *Doob grass, Indian couch grass.*—(Plate xii.)—A perennial creeping plant, with stems growing to a foot high; a good seed-bearer. It does not thrive well here. In the warmer parts of Australia it thrives in many instances too well, to the detriment of other grasses. It is said to be a good fattening grass. Many persons think this grass was brought from India, but as it is described by R. Brown in his *Prodromus* published in 1821, there can be little or no doubt about its being indigenous.

Plants of Cynodon pulchella and C. polystachyum from Queensland have been sent to me. They are apparently delicate, nutritious grasses, and well worthy of cultivation in country where the C. dactylon thrives ; they seed abundantly, particularly the last named.

The Doob grass was worshipped as a divinity in the East Indies, under the name of Darbha. Every law book and almost every poem in Sanscrit contain frequent allusions to the holiness of this plant. This and much more about it will be found in the works of Sir William Jones, vol. ii., pp. 58–60.

Chloris truncata.—(Plate xii.)—Perennial ; a rather low-growing, delicate grass, preferring a warmer climate than that of this locality; pretty common in some places near Melbourne, also in New South Wales and Queensland. I have heard it commended for its merits as a good pasture grass.

Dactyloctenium Ægyptiacum.—(Plate xxix.)—Tribe, Chlorideæ.—Several plants of this grass, gathered about thirty miles from Rockhampton, were sent to me. They are from eighteen inches to two and a half feet in height, and apparently annual. D. radulans, a smaller species, with numerous radicle leaves, is found throughout Northern Australia.

Hordeum pratense. *Barley grass.*—There is an annual and also a perennial species, both to be distinguished from H. murinum, or wall barley, by the spikes being flatter and more slender. I cannot say if they are indigenous, but I have seen one or the other of these species on uncultivated land in this colony, and in New South Wales

more than thirty years ago. The stems grow to two feet high; flowers in November; produces plenty of seed. Lying dormant during the heat of summer, it vegetates after the first rains, affording excellent nutritive food for sheep and other stock. It is not suitable for hay on account of the awns, which sometimes cause troublesome sores in the mouths of horses and cattle. The barley grass of Queensland, another variety, is very highly spoken of for its nutritive and fattening qualities.

Micralæna stipoides, Ehrharta stipoides. *Star grass.*—(Plate viii.)—Perennial; grows from one to two and a half feet high, producing but little seed. Where the kangaroo grass grows, this grass is generally found also; it does not, however, suffer so much from overstocking as the former. This grass appears to have two different habits of growth, erect in summer, and creeping in the same manner as couch grass in winter. Like the Poa Brownii, it keeps green during the driest summers. It is a good fattening grass; vegetates freely during winter, still affording nutriment for stock. Such a useful grass might be cultivated profitably for the purpose of raising new and good seed-bearing varieties. In flower during December.

Cinna ovata.—(Plate xv.)—Annual; found along the sides of creeks, and in wet and sheltered places. I gave it some years ago the name of *solitary grass*, from its habit of growing singly. I have never seen a large number of plants growing together. It grows to over two feet high, flowers early in December, and seeds plentifully. I have seen another awned variety in New South Wales.

Polypogon monspeliensis. *Mousetail.*—(Plate xiii.)—Flowers in December, seeds freely, and grows from nine to eighteen inches high, with delicate leaves. This grass is so scarce about here that I know but little of its merits, or those of solitary grass.

Panicum galli crus. *Barnyard grass.*—(Plate xiv.)—Annual; found along the sides of watercourses and in moist places on good soil; flowers in January and later; seeds freely. A low-growing grass with creeping habit, reproducing itself by suckers as well as seed. A useful and nutritious pasture grass.

The last-named three grasses are found, I believe, throughout Australia.

Numerous species of Panicum are found in the northern parts of Australia, of which thirty-six are enumerated by R. Brown. My collection contains specimens from the Far North, the Northern Territory of South Australia, and Queensland. 850 species belonging to the tribe Paniceæ are described by Steudel, which he divides into eighteen sections. Some of these sections are distinct genera of other botanists.

It is to be regretted that Steudel's work on the grasses has not been translated into English.

Only one species, Panicum galli crus, is found in this district.

The seeds of P. effusum and P. decompositium, are extensively used for food by the natives of Queensland. The seeds are pounded, mixed with a little water, and baked. They form also part of the food of the large flocks of pigeons and other birds; the seeds are similar to the common or cultivated millet, and are applicable to the same uses.

Several of the Australian species of Panicum are good pasture grasses, and very fattening. Some thrive on poor dry soil. Although mostly annuals, few grasses increase more quickly, owing to their being such abundant seed-bearers. Some of the hardiest species might be introduced with advantage on those dry, sandy tracts of country where grass of any sort is scarce.

Panicum ciliare (Plate xxix.)—of which a drawing is given among the Queensland grasses—and its allied species are common in Northern and Eastern Australia. A hardy, useful grass, doing its part in forming fattening pastures. In some of the species the seeds are so plentiful as to form a considerable portion of the edible part.

Another species I have heard highly commended; I think it is known as P. petiverii.

Several varieties of Eragrostis and Eriachne, judging of them by the specimens sent to me, ought to be good pasture grasses. I give drawings (Plate xxv.) of two species of Eriachne, one from Western Australia, the other from the Far North of South Australia.

Panicum spectabile.—Although not indigenous, the accounts of its merits when grown in South Australia, given by Mr. Phillips, are so interesting, that I think information about such a valuable grass as this appears to be cannot be too widely circulated. Mr. Phillips gives a description of this grass to Dr. Schomburgk, Government Botanist of South Australia, from which I extract the following :—

"The grass came up in the garden near the aviary, and no doubt came with the canary seed I bought. It is very prolific, seeding abundantly; it will grow in the driest places. The growth is very luxuriant, shooting vigorously about October, and continuing to do so until the cold weather sets in. It grows three or four feet high, with tall spikes of seeds, which are very pretty. It can also be propagated from the large couch roots, any joint of which will grow. It grows in the hottest weather, is very sweet and succulent, and cattle eat it greedily; it must not be sown on arable land, as it would be difficult to eradicate it. It would be useful on runs, not only for feed but also for stopping bush fires. If a plough were run across and across the run, and either seeds or roots planted, it would form a belt of green no fire would pass; a single line would soon spread a yard wide. A seedling will cover a square foot the first year; the roots also mat together, so that it is

useful to prevent watercourses washing away the soil. In stony places, if a stone is raised and a joint of root placed under it, it will shoot up all round, and never want re-sowing. If sown too early, the slugs eat it off; it should be planted pretty deep, or ants and birds eat it. It will sometimes lie two or three years in the ground."

I sowed in the garden some seed that was sent to me last year by Mr. Phillips. During my absence, when the plants were coming up nicely, they were pulled up as weeds; fortunately, however, about half a dozen were overlooked, which are doing well; but I expect the climate here will prove to be too wet and cold for them in winter.

The genus Lappago belongs to the tribe Paniceæ.

Lappago racemosa (Plate xxx.) is the only species I have seen. My plants are from New South Wales and Queensland.

Isachne Australis.—Annual. I obtained some plants and seeds of this grass. The seeds germinated, but the seedlings died off, or were eaten by slugs. This is a low-growing species; it might thrive on poor soil, where it would probably be found useful for sheep.

Panicum hispidulum (Plate xxviii.), which comes near some forms of P. crus corvi (Baron von Mueller), grows from six to eight feet high. My plants are from Consuelo, Queensland. It is perennial, producing plenty of seed.

Pennisetum Italicum.—(Plate xxiii.)—Annual; one to two and a half feet high; producing seeds freely, of which birds are very fond, so much so that I think they might be used as a substitute for the seeds of Phalaris canariensis. This grass is not indigenous about here. The plants I have are from seed mixed with those of other grasses which were sent to me. This grass resembles the Setaria viridis, as described by Parnell. I have plants of this grass from Consuelo. My informant writes that it grows from four to six feet high, and at a distance resembles a field of wheat.

Pennisetum glaucum.—Appears to be a variety of P. Italicum. The difference between them is very slight. There is another variety called, I think, P. compressum, having some merit as an early pasture grass; it is found in New South Wales.

Cenchrus Australis.—Annual. I have seen this grass in New South Wales; it grows from eighteen inches to two and a half feet high, and resembles, in some respects, Pennisetum verticillatum.

Paspalum distichum.—(Plate xxxi.)—A creeping, perennial grass, suitable for growing along the sides of watercourses and swamps; sends out long creeping stems, which sometimes float on the surface of the water to a considerable distance, throwing up a tuft of leaves at the joints; may be seen flourishing along the sides of one of the ponds of the

Melbourne Botanic Gardens, from whence my plants were obtained. Pigs are fond of the creeping stalks; horses and cattle ate quickly the small quantities I had to give them. Its nutritive properties are considerable. A drawing of this grass will be found among the Queensland grasses, to which colony I am informed it is indigenous.

Paspalum dilatatum.—(Plate xxvii.)—A perennial, rather late-springing grass, with plenty of radicle leaves; roots numerous, strong, penetrating; stems about two feet high; commences to flower in January, and continues to produce seed until the end of March; keeps green during the hot weather. This, in my opinion, is a very valuable grass. I exhibited plants of it at a meeting of the Ballarat Farmers' Club, in May of last year, and after the experience of another year, I can confirm all I then said in its favor as a first-class grass for grazing purposes. A Queensland stockholder told me he had seen this grass, or one closely resembling it, in that colony. My plants were obtained from the Botanic Gardens. Since writing the foregoing description, dried plants of this grass have been sent to me from Queensland, collected between two and three hundred miles from Rockhampton.

Rottboellia incurvata. Sea hard grass.—(Plate xviii.)—Annual; about six inches high. My specimens were collected from localities all within a few miles of Hobson's Bay. Of little or no use for grazing.

Hemarthria uncinata. *Needle grass.*—(Plate xv.)—So called by me from the appearance of the spike just before flowering. Perennial; one to two and a half feet high; in flower during January and later. This, with similar species, are common about salt marshes and lakes; not scarce about here; vegetates late; keeps green through the hot weather, and is then a favorite food with stock, which do not seem to care about it during winter. It is often affected with rust (puccinia) similar to that in wheat.

Sporobolus elongatus. Vilfa elongata.—(Plate xxiii.)—Perennial; grows to three feet high; flowers in November; matures a good deal of seed; found in different parts of this colony; a handsome grass, with plenty of bright-green leaves, but it does not grow about here; very hardy; its numerous penetrating roots enable it to stand the summer heat well. Beyond knowing that it is eaten by stock with other grasses, I am without knowledge of its nutritive and fattening qualities. At times the leaves appear to be tough, as if this grass might be useful for fibre purposes or straw plait.

Sporobolus pallidus.—(Plate xxvi.)—This grass is found in Queensland and the Far North. Baron von Mueller terms the specimen I sent a contracted variety. I have several plants, but none of them exceed ten inches in height. S. matrella is a rather coarser species; both are worth testing.

Sedges.

The Cyperaceæ Sedges, or Sour Grasses—in which I include such genera as Xerotis, Carex, Scirpus, Heliocharis, Cladium, Cyperus, Chætospora, &c.—are numerous in this locality. With a few exceptions, they are worthless for grazing. Rust appears to be chronic with some of them. The Carices, as a rule, are deficient in saccharine and nutritive matter, and have no fattening qualities. Succulent and green in summer, when other herbage is dried up, these plants have an attractive appearance, but stock avoid them unless very hungry. It frequently happens, as the native grasses are destroyed, their places are occupied by various members of the sedge family; for instance, a low-growing sedge, Lepidosperma lineare, occupies large patches of land in the country around Geelong and elsewhere, where formerly native herbs and grasses grew.

Carex longifolia, or (Plate xx.) riparis, of which a drawing is given, is a rather handsome but useless species of this family.

Carex inversa—(Plate v.)—unlike others of this family, flourishes in dry places, keeping green during the hottest summers, and forming a close turf. It is eaten by stock in common with other herbage, but it does not appear to be a favorite with them.

Eriophorum. Cotton Grass.—This genus was included by Sinclair with the true grasses, because the English species were eaten by cows, oxen, and sheep, in common with those species of proper grasses with which they happened to be combined, while the species of other genera of Cyperaceæ growing on the spot were rejected. I have heard that at least one species of this genus is indigenous to Tasmania.

Chætospora axillaris.—(Plate xx.)—Common in the Ballarat district, growing in winter when other plants are dormant; all sorts of stock are fond of it. This plant is an annual, springing up after the first winter rains; fit for grazing in four or five weeks; continues to grow and spread until dried up by the sun, when it dies, leaving abundance of seed for a future crop. Average height about six inches.

Two or three other low-growing plants of this family thrive with clover and grasses in moist situations during summer, and are grazed off in common with them. In certain parts of America this description of herbage may be of a superior sort. I find it stated in the Report of the Department of Agriculture, 1870—"The Cyperaceæ are largely consumed by stock, and are even made into hay where abundant. The large family of Carex afford the best species. Though less nutritious and palatable than most of the true graminaceous plants, they are highly valued and largely used in some mountain districts. Carex gayana in the mountain valleys of Colorado affords the principal hay of

the country; but many other species are used both for hay and pasturage. The relative merits of the several species depend more on quantity than quality, excluding a few of the coarse aquatic kinds that are quite worthless."

Two years ago I obtained some plants and seeds of a New Zealand Carex, which grows well here among my specimen plants. It was said to be valuable for pasture in that colony.

Queensland Grasses.

The qualities of the numerous grasses of Queensland would furnish an interesting subject for inquiry for any one who had time and inclination for such an occupation, combining as they do some very ornamental species with others of the most useful description for all kinds of stock. I am aware this subject has not been altogether overlooked. More than a year ago there appeared in the *Australasian* an interesting article—one of a series taken from the *Queenslander*—relating to the native grasses. From the shores of the Gulf of Carpentaria to the confines of New South Wales the herbage on the best tracts of country is unsurpassed for fattening qualities. A gentleman who had a station on the head waters of the Flinders told me that the cattle there frequently became so fat that the cows ceased to breed; on the other hand, instances are not wanting of the most extraordinay fecundity in sheep. One on record, of a station on the Flinders, taken up in 1865, with 2200 ewes, in twenty months 6400 sheep were shorn. To counterbalance all this, there is much inferior country, and some localities are unsafe for grazing on account of the presence of poisonous plants. A most interesting description of some portions of Northern Queensland is given in a work called "*A Narrative of the Overland Expedition of the Messrs. Jardine from Rockhampton to Cape York*," edited by F. J. Byerley. Some plants of Queensland grasses—Andropogon haleppensis, Paspalum distichum, and Chloris—have been grown successfully by me here, in common with many other species of extra Victorian grasses. Of the ordinary grasses a number of dried specimens have been sent to me, several collected within fifty miles of Rockhampton. As they differ in appearance from Victorian grasses, I have had drawings made of some, which may be interesting to compare with species indigenous to Victoria. The drawings are faithful representations of the following plants:—

Dactyloctenium Ægyptiacum. Plate xxix.
Lappago Racemosa. Plate xxx.
Paspalum distichum. Plate xxxii.
Chloris divaricata. Plate xxxii.
A. Poa, section Eragrostis. Plate xxx.
Panicum ciliare. Plate xxix.
Eleusine indica. Plate xxxi.
Eleusine *distachyum*. Plate xxxi.

ON DISEASES AMONG STOCK.

By Mr. W. Thomson, F.R.C.S.

To gather full information respecting prevailing diseases among stock in this colony the Secretary for Agriculture, early in the present year, sent printed circulars to stockowners in every district, requesting them to communicate the requisite particulars. In the answers returned the various districts are fairly represented, but it is not always certain what reliance can be placed on the exactness of the information, nor easy to arrive at correct conclusions as to the extent of disease or its precise nature. There are few, and, in many cases, no answers from localities known to sustain heavy losses from disease amongst sheep, nor any from the best informed and experienced stockowners ; while some answers come evidently from small holders deficient in experience, and unacquainted with the diseases mentioned. These furnish evidence of the need of some veterinary training school for those who mean to follow pastoral avocations. Some of the replies have evidently been reluctantly given, probably with reservation ; and it may not be unfairly inferred that the information given in no way exaggerates, but rather understates, the amount of disease among stock, there being probably more than stockowners generally care to mention. This suggests many serious and important considerations.

From Eastern Gippsland to the South Australian boundary, pleuro-pneumonia is more or less prevalent among cattle, whilst heavy losses are met with on many stations from the ravages of fluke, which alone occasions a fatality ranging from five to twenty per cent., with additional heavy losses from foot-rot.

In the north-eastern districts, along the ranges, west and north-west from the Australian Alps, the same diseases occur ; as well as along the northern and southern slopes of the Great Dividing Range which trends westward through the entire colony from the sources of the Goulburn River to the western end of the Grampians.

It is somewhat remarkable that the three diseases named seem generally co-existing in the same herds and flocks ; that is, wherever pleuro-pneumonia is found among cattle, there fluke and foot-rot occur in sheep. In some cases foot-rot is alone named ; but generally foot-rot and fluke go together. The exceptional cases of foot-rot mentioned are probably amongst purchased sheep that have not yet become sound ; for assuredly one station named should have neither foot-rot nor fluke upon it.

There are some very important deductions to be drawn from the mass of information given, and as the statements generally agree with known facts, they are entitled to the most careful consideration.

First.—From six to ten years ago there was great loss among cattle from pleuro-pneumonia in nearly all the districts of the colony.

Second.—Solitary cases have occurred in many localities ever since.

Third.—Last year great numbers were attacked with fatal results, although the disease was often thought of milder type than at its outbreak ; a feature in all essential diseases.

Fourth.—Inoculation is generally practised by stockowners, and is believed to be preventive of the disease.

Fifth.—Blistering, or firing with kerosene, is much practised as a supposed remedy.

The deductions to be drawn in reference to fluke are :—

First.—In the Benalla or North-Eastern District, and in Gippsland, fluke has long been in existence, causing heavy losses among sheep, losses ranging from five to twenty, or thirty, or even fifty per cent. per annum.

Second.—Fluke disease was either unknown or was unnoticed in the Western District till within the last three years; the losses becoming heavier, and the disease rapidly spreading, having appeared in some localities for the first time within the last twelve months.

Third.—Fluke disease has only recently appeared in the country flanking the central Great Dividing Range, a belief being held that it has been brought by selectors fetching fluky sheep from other districts within the last two years.

Fourth.—In all fluky districts losses increase. On some stations in the more recently infected parts the deaths reach 4000 yearly ; in others to twenty per cent., seldom under five. In older fluky districts the losses from fluke and other diseases have become so severe that the keeping of sheep must soon be relinquished, or the country abandoned, unless some efficient preventive be found in abundance of salt, or other remedy.

The deductions to be drawn from the information respecting foot-rot are—

First.—Foot-rot prevails to a greater or less extent throughout all the fluky districts, and is seldom met with elsewhere.

Second.—The actual loss from this disease is considerable, the number of deaths ranging from one to five per cent. per annum.

Third.—Foot-rot causes heavy expenditure by demanding great labor and attention, besides inflicting exhausting suffering upon the animals.

Fourth.—The remedies usually resorted to are paring, and turning into shallow troughs, leaving the affected animals standing for a few minutes in a mixture of arsenic and water, in the proportions of two ounces to a gallon.

The other diseases that are mentioned as causing losses amongst stock are :—

Rheumatism,
Consumption,
Tumors,
Swelling at root of tongue,
Blackleg,
Glandular swelling,
Hydrothorax,
} affecting cattle.

Worm disease in sheep (strongles ?).
Coast disease, affecting sheep, cattle, and horses.

Numbers of sheep appear to die from eating poison plants in all parts of the colony.

It should be borne in mind that the information furnished has not come from scientific experts, and therefore must not be accepted as absolutely correct. Most probably different diseases have been confounded. Consumption, mentioned by four stockowners, may have been mistaken for the later stages of pleuro-pneumonia.

In that case it would be accurately enough described as a form of consumption; that disease being now, by modern pathologists, looked upon as one having a great many varieties; not the least common of which results from specific inflammation of the lungs as the sequela of specific contagious fever, such as pleuro-pneumonia is now universally admitted to be. It is also possible that the affections described as "swelling at the root of the tongue," "hydrothorax," and "glandular swelling," are closely allied as to cause and nature.

Some of the diseased states enumerated are, as regards districts, of purely local character. Rheumatism is restricted to very wet, swampy lands near the coast. Blackleg is mentioned in connexion with only two herds. One gentleman, of much experience, states that this terrible

disease appeared amongst some cattle at Dandenong in 1845, but that it has never been seen there since.

The existence of diseases that cannot be named by the correspondents being of frequent occurrence forms another indication of the want of an establishment wherein some knowledge of the diseases of animals could be acquired by stockowners, especially by young men preparing to enter into such pursuits.

One of the so-called unknown diseases is described as being attended with tumors on all parts of the body. Another, as described, is evidently the result of sheer starvation, the country being unsuited for sheep. On the sand tracks along the coast, sheep, cattle, and horses suffer from an accumulation of sand in the intestines. Horses and cattle are less affected than sheep, as they feed in the swampy places. The remedy is removal to other pastures as soon as symptoms are observed.

It is a noteworthy fact that from large areas of the colony no answers have been obtained. This is especially the case in the extensive basaltic plains extending westward from near Geelong to the South Australian boundary. Answers from the Wimmera, Avon, Avoca, Loddon, and Campaspe plains are isolated and incomplete. It is difficult to account for this reticence; but from what is known of those districts, it will probably be correct to assume that the stock is generally healthy, owners not replying from having nothing affirmative to report.

After a careful analysis of the whole evidence obtainable, incomplete although it undoubtedly is, the following conclusions may be fairly drawn:—

First.—That there is a very serious amount of disease amongst all kinds of stock in this colony; and that the various diseases are increasing in destructiveness; that fluke is rapidly spreading into fresh districts hitherto exempt; and that it is becoming more fatal among merino sheep.

Second.—That the colony sustains a very heavy annual loss from disease, large numbers of cattle dying from various diseases, and immense numbers of sheep from fluke, the deaths representing but a portion of the loss sustained, the wool of unhealthy flocks being inferior in quality and lessened in quantity. Unhealthy flocks and herds deteriorate physically. The animals get small, and never become fat and marketable. If the owner converts them into money by sales as store stock, he gets a low price, and the animals carry disease with them into clean and healthy localities.

Third.—That many of the diseases might easily be prevented or cured.

Fourth.—That there is a want of knowledge of veterinary science amongst stockowners, so that many animals are suffered to die that better knowledge would save. If stockowners became more conversant with the diseases incident to domestic animals, their own immediate advantage would be served, with ultimate great gain to the whole colony. Not by any means that it is desirable to train stockowners to qualify them as cattle-doctors, employing their time in drenching and dosing; the great object to be attained is rather to induce young men to devote themselves, during their education, so far to the study of veterinary science as would initiate them into a knowledge of the general laws of cattle hygiene, and to impress upon their minds the unerring truth that violation of them openly, or by neglect, brings the poverty, disease, and death which their fathers now deplore. A stockowner, in such a country as this, should be ready to grapple with every disease to which his charge is prone, and which at any moment may place his fortune at stake, not merely with curative measures, but be prepared, by anticipation, with means of prevention. This, it is but the tritest of truisms to state, is alone to be done by observing well-understood and clearly defining laws of health—laws as inexorable as those that control his own well-being as a member of the human family. He may rest assured of ever finding his own highest interest served by treating with kind intelligent consideration the animals that prosperous fortune has placed under his care. But this he will only be able to do by carefully studying their whole economy. Human beings, as free agents, enjoy the privilege of breaking Nature's laws and knowingly abiding by the consequences; but when ill they can send for a doctor and get cured or relieved, as peradventure may happen; but dumb brutes under the dominion of ignorant, unfeeling, though not naturally cruel, if greedy owners, are often shut up in swampy paddocks, without a dry spot to rest upon, with only innutritious water-grass to eat, and with no shelter from a storm. Their masters having no feeling, and less intelligence of the case, can only murmur at ill-luck, while the sufferer's lot is to endure in silence, become diseased, suffer, and die; and, while their bones are bleaching, the Agricultural Department receives intimation of many deaths

from "an unknown disease." It would be ungenerous and unfair to allege heartless conduct to owners generally, or even to any considerable number; yet, there is every reason to believe that more than three-fourths of all the diseases amongst stock in Victoria are actually due to a want of intelligent judicious management. The reason why so many sheep now suffer from foot-root, not arising from fluke-rot, is easily explained to be because they are kept, in many instances, on lands in a wet and undrained state, unsuitable for sheep. To preserve the feet of sheep in a sound condition, they should be dry and clean and freely exposed to the fresh atmospheric air during the night. But sheep are kept on wet lands, with poultices of wet clay between the clefts of the hoofs throughout the night; for thus in these tender parts all foot-rot proper begins.

The spread of fluke over so vast an extent of the colony is primarily due to carelessness in purchasing fluky sheep, raised in fluky districts of this colony and of New South Wales; but its growing fatality arises from defects in the general health of stock from depreciation of pasturages. Lands once dry and healthy have become wet and swampy, through the trampling of stock rendering the surface soil impervious. Then innutritious water-grasses grow while nutritious ones perish, leaving a want of that mixture of grasses and herbs which are essential to health in cattle there depastured. There may be seen a rank appearance of plenty of grass, and the land may thus be as heavily stocked as ever, but the general health of the sheep deteriorates; they lose condition, every generation growing physically smaller and weaker than the predecessor. Then, obediently to the all-pervading natural law which ordains that, when animals of higher organization fall into decay, or their vital energy becomes, through deficient nutriment, impaired, the terrible parasitic tribe shall infest their bodies and thrive on their debility. It may thus plainly be foreseen that, unless means be taken to drain the lands, reduce the number of stock depastured on any given area, and so improve the nutrient qualities of the pastures, fluke must inevitably spread, and year by year cause greater devastation. Meantime, salt ought to be freely given. Salt renders dry food more digestible, and gives strength to stock, even when infested with fluke. Moreover, when once used, it is never lost. It is not decomposed by the digestive organs, nor in its passage through the body; its office in the animal tissues being performed by some hitherto unexplained contact action, not chemical. Salt is no more chemically altered

within the living tissues than it is changed in the brine-tub; yet it conserves the living tissues as thoroughly as the not-living flesh. It is Nature's grandest of antiseptics, and is supplied by nature bountifully; but is distributed by man's niggardly hand so as to bring upon himself the hard consequence of his cupidity that breaks Nature's cycle. The instinct of the starved animals would teach him a salutary lesson in animal economy, if his conceit, and pride, and greed, would only allow him to be so taught. The readiness with which sheep devour salt bush should show him Nature's wants, and tell him that if he have, by overstocking, destroyed the life-preserving herb, he should supply as freely the health-sustaining substitute. But, no, while he superstitiously bemoans the events that bring him ill-luck, he indolently stands by without putting forth rationally directed efforts to divert them. It is a significant fact that on one station—where neighboring sheep are dying by thousands from fluke—there is no fluke; the simple explanation being that, on the station that enjoys this immunity, there are some salt lakes.

In a more general way it might indeed be inquired, what pains do stockowners bestow by way of artificially supplying their flocks with food and shelter? protecting them from hot winds or stormy weather, to make them comfortable and contented? for even sheep must fatten in contentment. Must the answer not be simply and emphatically, as a rule, absolutely nothing. Wide open plains are fenced with post and rail, or wire, but where are the planted trees or shrubs? No shelter is there for either pasture or stock. The primal forests are cut down, the land is denuded, and left bare, the better to foreshadow the poverty approaching. When it comes stalking in amongst us, men will call it a visitation of Providence, rather than the outcome of their own stupidity in not recognising the fact that land is not an inexhaustible source of wealth, but only a mere multiplier of that which is by industry carefully put into it. Sheep farming, as much as grain farming, needs husbandry; but Victorian stockowners would wish it were otherwise, and have acted as if it were so.

The Northern and North-Western Districts of the colony seem to enjoy remarkable immunity from nearly all diseases. These districts possess a milder winter climate than any part of the colony. Their geological formation is also entirely different, consisting of tertiary drift, and containing more or less saline ingredients, whilst subsoil plants are in more or less abundance.

There is likewise much greater variety of food for stock, consisting of grasses, herbs, and shrubs. But even in the outskirts of this generally

salubrious level tract of country fluke and foot-rot are encroaching. The former disease is probably kept at bay only by the strong healthy condition of the stocks, while the latter disease perhap exists alone in stock recently brought from other districts.

It is rather surprising to find great losses reported as occurring amongst sheep in heavily timbered mountainous tracts of country, and ascribed to unknown or unnamable diseases, whilst similar reports come from poor sandy tracts of desert country, the losses being also ascribed to an equally unknown or undefined malady. Judging by all the symptoms, these undetermined diseases have a common history, and seem to be neither more nor less than the result of unmitigated starvation, either through the stocks getting little or nothing to eat, or because what grass they do manage to pick up contains little or no nutriment. The wonder is that sheep should be kept on such tracts of country at all. It is little short of cruelty to the animals, a consideration that may not so readily stop the practice as will the unprofitable nature of the occupation.

From the foregoing account it will readily be observed that, with the sole exception of pleuro-pneumonia, all the diseases mentioned are visceral affections, or what are known as local diseases of the animal economy. These are classed in contradistinction to the great order of blood diseases affecting the whole system. From the majority of such general diseases the colony remains as yet happily exempt. Many formidable diseases of a local kind, such as trichinosis, do not seem to have found their way hither, for no mention has yet been made of them as having appeared in the colonies. But it is not safe to be too sanguine on this point, since some other grave maladies, well known to exist amongst our herds, receive no more attention ; as, for example, that strange affection of young thorough-bred horses, absurdly enough misnamed *osteoporosis*, and better called nasal disease—the former high-sounding pseudo-scientific term being grossly misleading as to its pathology, the latter name being sufficiently precise, nor falsely suggestive of erroneous notions of the cause or nature of the disease. To omit all notice of nasal disease in an account of the diseases of stock would appear strange after the great interest taken in England in accounts of it sent thither, an interest not confined to veterinary writers alone, but extending to authors of works on general medicine. It is referred to in the *Medico-Chirurgical Review* of July 1873, in an able article enforcing the claims of comparative pathology as an essential medical study, and showing how far behind Continental States the medical institutions of Britain were in that respect. Referring to the nature of

nasal disease, the reviewer admits that its period of growth and its causes are not understood. In a recent discussion by the Veterinary Medical Society the same obscurity was freely admitted. In the face of such facts it could hardly be deemed impertinent to attempt its investigation here. An extensive breeder of thorough-bred stock, fresh from the old country, advised those whose animals were seized to send home for an opinion, as there alone could veterinary authorities tell all about it. When sent for, the opinion still was dubious. How could it be otherwise, when pathological histologists, like Rindfleisch, confess that "the etiology of osseous softening is yet unknown to us"? Possibly, pathological investigations conducted out here could not have thrown any fresh light upon the obscure subject; yet, observations of the general conditions under which the disease occurs, of its progress and terminations, of the appearances after death, or, more especially, of the conditions under which recoveries have taken place from a diseased state usually found elsewhere invariably fatal, would have been appreciated as of high practical utility as well of much scientific interest. At any rate, the whole of the circumstances afford additional illustration of the need of a veterinary school here, where our youth may be trained to self-reliance, rather than to lean, like their fathers, everlastingly upon second-hand information. It will be wiser policy of the State to follow, not the example that neglects such studies, but of those countries that encourage and in every way foster the study of comparative pathology. The fact that horse rickets has not been mentioned in these returns proves that the disease does not now greatly prevail. It never was met with amongst young stock in a natural state. In every instance it was found only amongst young animals trained under most unnatural conditions, for purposes of premature development; the pathological state so induced being merely an exaggeration of a normal or physiological condition. If this fact had been fully brought out, and the principle of false growth justly applied to illustrate the effects of erroneous methods of rearing young human beings, it would have served aptly to illustrate several characteristic traits among Australian children that have often attracted attention, and so would have shown the value of comparative pathology in a novel way. Whenever the young system is over-stimulated by unnatural agencies to produce an artificial precocity, some morbid condition of bodily and mental growth must be the inevitable result—a truism that one might almost feel ashamed to repeat, were it not necessary by the wonderment often expressed at moral, social, and physical diseases, whose causes, although plain and obvious, are yet, through ignorance, deemed mysterious and

inscrutable. Moralists may lament, and by preaching try to rectify the effects of mistakes in physical nurture; but as vainly so as if the groom used his whip to make the osteo-malaceous colt, crippled by his own cupidity in unnatural forcing, try to stand upright. The children who, twenty years ago, were "weaned on mutton chops and brandy," are the hyper-nervous youths who to-day cause the State so great perplexity. The action of the cause was then as clearly foreseen as the full effects are now obvious.

But the most important fact brought out by the replies to the circular is that, except contagious lung disease, no contagious, essential, zymotic, or reproducing blood disease exists in the colony.

No sort of fever rages amongst the flocks or herds of the colonists. Destructive as all other diseases are, they seem harmless when contrasted with the devastation that would sweep across our plains by the introduction of an epizootic—for example, of foot-and-mouth disease, of cattle plague, of glanders, or of small-pox of sheep. The very narrow escape from the inroad of foot-and-mouth disease, with the full knowledge since gained of the havoc that the then thought mild fever has made in other countries, into which it gained, through supineness, an ingress, should put our legislators upon the alert against its possible return. The manner of its importation should serve as a typical illustration of the mode of introduction of all similar zymotic fevers. As the contagions of pleuro, of foot-and-mouth fever, of small-pox, came, so must the contagious poisons of all analogous diseases come. Governments must act on the postulate that the poisonous germs of all reproducing fevers, amongst man and animals alike, from cholera to glanders, must enter these colonies water-borne; and that no such diseases ever originate from poisonous germs generated *de novo*. This last asserted mode of origin is a fine enough philosophical speculation, an ingenious but vague conjectural hypothesis, of which never anything practical can be predicated; while the ordinary mode of contagious propagation is an every-day fact demonstrated by ten thousand national and domestic tragedies.

These affirmative assertions are just now all the more urgent and imperative, because of the immediate necessity of confuting the statements in a report from Chief Inspector Mr. Alex. Bruce to the Legislature of New South Wales. Should the recommendation therein made to open our ports be adopted, the most disastrous consequences will follow. Mr. Bruce has been at great pains to explain how pleuro-pneumonia was, from cupidity and carelessness in connexion with an imported animal, brought into these colonies; how that fatal act has

cost the colonies many millions of money, with contingent losses beyond calculation ; how foot-and-mouth came, and how other zymotic fevers likewise alone can come ; and yet he illogically proposes to relax the prohibition against importation which the Legislature wisely passed to save the stockowners and the country from ruin ! Of course, such is far from Mr. Bruce's intention ; but that such will be the fruit of his sincere but mistaken proposal there cannot be any doubt.

Mr. Bruce fully admits the necessity for precaution against importing contagious diseases along with animals brought to improve our stock ; but thinks that with this caution the colonies are not exposed to any danger, so long as these animals are brought only from Great Britain. He argues that because great pains are now taken against bringing diseased animals from the Continent into England, that therefore there is little risk of fetching diseased animals from England hither.

Fortunately, we are to wait as we are until Great Britain becomes free from foot-and-mouth disease before free importation be permitted. How long that time may be of coming may be judged of by the reports published in the *Veterinarian* of March last, where (page 164) foot-and-mouth disease is reported as having been gradually increasing in localities far distant from one another, adding the consoling reflection that " periodical accession and decline in the severity of the disease are characteristic of it, and not easily accounted for."

After the alarm and expense the colony was put to so short a time ago about the introduction and spread of epizootic aphtha, it seems premature and ill-judged to recommend to the Legislature to make any remission of the prohibition against the importation by accident of contagiously affected stock. But that Legislature which, in the teeth of its own Commission's advice, passed a law to avoid such risks, and watchfully guards the people against small-pox, cholera, phylloxera, *et hoc genus omne,* will not readily change its temper.

Mr. Bruce combines with his report a lengthened description of the various contagious fevers to which all stock in the colonies are exposed by importation of diseased animals, as if he were anxious to prepare stockowners for the advent of those very diseases most likely to come to us under the relaxed prohibitory measures which he recommends. No system of quarantine, however vigilant, will keep out those contagions ; and the only safe preventive is absolute prohibition, as now obtains. It will be suicidal to repeal that law. Infinitely better is Mr. Bruce's warning against the possible and not at all improbable introduction through Western Australia, South Australia, or Queensland, from India or China, of some of the deadly diseases now raging in those countries—

fell diseases to be brought hither "by some comparatively worthless Timor pony, buffalo, cow, pig, or goat, to decimate our flocks and herds." To guard against such disasters some joint action among the Australian colonies cannot be too soon set about.

From the fact that Mr. Bruce felt it advisable to publish in his report to parliament a detailed history of the nature, symptoms, and most approved mode of treatment of the various contagious fevers, it would seem that he recognises the want of systematic teaching of veterinary science in these colonies, and will probably lend his great influence to promote the establishment of such schools without delay. The proposal will likewise doubtless receive all support from the medical profession. It is now recognised fully that the leading principles of human and comparative medicine are identical. Just as no man can be a surgeon who is not also a physician, and as no man can be a physician who has not studied fevers, so no man can clearly comprehend the whole doctrine of fever who has not studied the subject comparatively. It would be as impossible to do so as it would be to understand the subject of ordinary entozoa without tracing their mutations through the bodies of different animals. In every medical text-book now-a-days great stress is laid on the need of medical students devoting more attention to comparative pathology. In the *Medico-Chirurgical Review* for July 1873 it is stated that Sir Astley Cooper took the greatest interest in promoting veterinary science, for the benefits human medicine might derive from the study of comparative pathology, and also that in Germany it is not at all rare to find medical men who are veterinarians, and veterinarians who are medical men.

In a late number of the same Review, that for January 1874, there is a most elaborate and exhaustive article from the pen of Dr. Lauder Lindsay, on the "Community of Disease in Man and other Animals," in which it is stated that "a wonderful revolution has taken place during the last twenty years, in public and professional opinions, regarding the attention due to the study of the diseases of the lower animals. The cattle plague of 1865, the horse epidemic in America of 1872, the various recent cases of typhoid fever produced by poisoned milk, &c., &c., have all contributed to this result." Dr. Lindsay believes that "the experimental study of the diseases of the lower animals is at present the most promising direction or source in or from which to expect material assistance in further research on those of man; that the diseases of animals arise from the same causes, exhibit the same symptoms, and require the same treatment or remedies as those of man—*mutatis mutandis*—making all due allowances, that is, for

differences in structure and habits ; and that few, if any, diseases are absolutely peculiar to man."

These views of Dr. Lindsay coincide closely with those expressed in a paper read before the Medical Society of Victoria, and published in the *Argus* of 10th March 1864, that "as animals have a physiology in common with the human race, so have they a pathology. The unity of design in structure and function is equally manifested in health and in disease. What is true of epidemics is, *mutatis mutandis*, equally true of epizootics ; what of endemics, of enzootics. The diseases are not only closely allied, they are identical—*mutato nomine de te fabula naratur*. All the fevers incidental to humanity are reproduced not only in the equine and bovine, but in all other species brought under the same physical conditions."

As exception may be taken to the views expressed on the effect of impaired health in predisposing to attacks of parasites, it should be explained that by the remarks it is not meant to imply a belief that parasites are generated *de novo* through low condition. This it is the more necessary to state, because Professor Cobbold has, quite recently, in a popular lecture, spoken very emphatically against so improbable a supposition. There can be no doubt that the ova of all parasites precede the appearance of the full-grown organisms. If a man in prime health swallow a cysticercus, he will assuredly have tape-worm ; or an echinococcus, and he will as certainly get hydatid, in his liver or his brain, and be sent to a hospital or a lunatic asylum, as misfortune turns. Vigorous health affords no safeguard against the inroads of such pests of man and brute. What was alone intended by the remark was a reference to the effect, often noticed, of abundance of saline herbage in strengthening, fattening, and preserving animals from entozoa. The two facts so invariably go together as to suggest cause and effect. Whether substitution of artificial supplies of common salt would serve the same end, or be practicable on a large scale, are different questions, not affecting the theory. The observation is in accordance with known effects of deprivation of salt. That in ruminants it prevents the bad effects of wet pastures has long been understood. By ancient Draconic laws of some countries, prisoners deprived of salt became tortured with worms. Kangaroos are infested with them. Goats will lick the sweat from a horse's legs for sake of the salt in it. Sheep and cattle will forsake their lick-pits if duly served with salt. Similar proofs of the craving of animals for salt, and of its beneficial use in the food of animals, as showing its physiological necessity in their systems, could be endlessly given ; enough are adduced to bear out the allusion to the subject. Salt

supplied to animals intended for fattening, gives consistence to the fat, and would therefore seem to exert special influence over the secretions of the sebacious glands situated at the roots of the hairs. In this indirect way it may, by keeping the hair or wool greasy, prevent the ready growth of parasitic ova. At any rate, sheep deprived of salt do become affected with parasites, their fat is thin, and their flesh watery, very much as is seen among phthisical people, who, having a strong aversion to salt, lose fat, and have their flesh pale, soft, and watery, as the researches of Dr. William Marcet have so fully shown.

There is another circumstance that may be here mentioned as instructively suggestive of the efficacy of salt in preventing fluke. Quite recently reference has been made to a certain breed of sheep said to be, from some constitutional peculiarity, non-liable to that parasite; and it has been proposed to cultivate the breed extensively over the colony. Now, while it is quite possible that there may exist such racial immunity, just as there is in some people, as is by many believed, a constitutional liability to hydatids, or a hardy breed of potatoes not susceptible to the attacks of the free ciliated zoospores of the *peronospora infestans* or blight, still, since the proofs are by no means conclusive, other explanations of the appearances may be sought for. Thus, in reference to the peculiar breed of sheep, it should be borne in mind that they came from a station on the sea coast, where the sea was shut out by dykes, but which it often broke over, inundating the land over which the sheep grazed. In this way the salt water would wash over and saturate the ground, destroying the fresh-water molluscs that, as has been all but demonstrated by Cobbold and other helminthologists, serve as the intermediate hosts for developing the cercarial larvæ of the *Fasciola hepatica*, or the cercariæ themselves, should any of the hosts happen to escape the deluge. Thus, even supposing fluke-infested sheep to be taken on to such a country, the parasites would soon all disappear for the want of means of sustaining and rearing the larvæ in their various intermediate transmutations, the alternating generations of Steenstrup. Not only would this afford a more satisfactory account of this supposed immunity, but it also suggests the true mode of dealing with fluke in the use of preventive measures. It likewise fully explains the rationale of salt lakes in preventing fluke by affording no nursery grounds for its larvæ. It further explains why the abundant use of salt to adult animals affected with fluke fails to eradicate the pests, because, unless the supply be also ample enough to destroy the larvæ in the wet grass, it can have no destructive influence. It is believed by many competent judges that this is the true direction which

further investigation should take in seeking for a remedy for this great and growing evil.

But although common salt has an undoubtedly destructive influence over fluke and some other intestinal parasites, it seems not merely powerless against the growth of hydatids, but rather to be nutritive to them, the sacs of hydatids being actually filled with a strong solution of that substance, chemical analysis having long ago shown sodium chloride and soda succinate to be the chief ingredients in hydatid fluid, in which the young vesicles live. The practical bearings of this fact may not appear very obvious, but it serves to draw a specific distinction between the ova of fluke and the ova of hydatids, such as a recent discussion of the subject in regard to public health made necessary. The great and increasing prevalence of hydatid disease in the human body in this colony lends additional interest to such questions. This prevalence, however explained, seems due to the quantity of warm water drank by man and beast from shallow pools in summer time, water at a high temperature, as that of the warm rivers of Iceland, where hydatid disease is, as here, endemic, favoring the growth of the embryo hydatid. If this should prove to be the true explanation, it will show the absolute necessity of preventing dogs from harboring near such pools, as well as from the watershed of the Yan Yean Reservoir. It is a well known fact that on stations where grazing paddocks are carefully fenced, so that dogs are no longer required for shepherding purposes, there has been observed a marked diminution in the number of cases of sturdy, simply because no dogs discharge the immature ova of their tape-worms into the pools nor on to the grass where the sheep drink and browse.

As further illustrations of the tendency in recent times towards closer fusion of human and comparative medicine may be mentioned the investigations of Dr. Murchison to test how far the lower animals are liable to enteric fever, and whether cattle plague, intestinal fever in pigs, and similar febrile states in horses, were pathologically analogous to human typhoid. Also the researches of Dr. William Budd into the laws of contagion as exemplified in *variola ovina*, or sheep small-pox ; the demonstrations by Dr. Lionel Beal of the diseased bioplasm in the blood in cattle plague ; similar inquiries into the condition of the blood fluids in contagious lung fever by Dr. Shearman Ralph ; and finally, and greatest step of all, the publication of the beautiful anatomical treatise of Professor Chauveau, wherein veterinary students must study the anatomy of the domestic animals along with that of man.

Those indications of the medicine of the future will serve to guide our Government in determining the form in which a veterinary school

ought to be established here. That it should be at the University, and in conjunction with the medical school already in operation, there can be no doubt. Such an amalgamation would make veterinary medicine more scientific, human medicine more comprehensive, and both more useful.

In preparing this report the writer has to acknowledge with pleasure the assistance kindly given by Mr. Lockhart Morton.

P.S.—Since the above remarks on comparative medicine were in type, the April number of the *Medico-Chirurgical Review*, one of the leading purely scientific medical periodicals of Britain, has come to hand, containing an article on *Comparative Therapeutics*, from which one or two appropriate words deserve to be quoted. The reviewer observes that "To their honor be it said, members of the medical profession were the first to rescue veterinary medicine from the degraded hands of the farrier;" and cites Bracken, one of the pioneers, thus:—"Therefore, let not my brethren murmur and complain at me, as if I were debasing the profession, seeing it is certainly a fact that he who cannot write sensibly about the distempers in brute creatures is not qualified to prescribe for man, by reason, 'tis plain, he has not studied nature thoroughly." And after a most interesting review of the variations in the effects of medicinal substances upon different animals, the reviewer alluding to Dr. Burness and Mr. Mavor, the joint authors of the work under notice, concludes with a remark that "It is very rare, indeed, to find a physician and a veterinarian uniting in researches towards accomplishing the same object—the cure of disease in man and beast. The success of the present inquiry clearly demonstrates what valuable ends may be attained by such combined investigations, and how materially two such experimenters can assist each other, and advance the progress of science."—W. T.

APPENDIX.

Analysis of the whole Information.

District.	Diseases.	Losses.	Remarks.
Beechworth:			
1	Pleuro and consumption	10 per cent.	
2	Pleuro, fluke ...	...	Gives sheep coarse salt and sulphate of iron. Believes they do good, but still loses a large number annually.
3 ...	Pleuro	½ per cent.	
	Consumption ...	2½ per cent.	
	Unknown disease	5 per cent.	The cattle affected by it get tumours in all parts of the body. Cattle also get fluke, but their health does not seem to be affected by it.
	Rheumatism ...	1 in 1000.	
	Foot-rot	...	Slightly.
	Fluke	Unknown...	Kills a large number of sheep. All the above remarks apply to the district.
4 ...	Pleuro	1 per cent.	
	Fluke	1 per cent.	Cattle are infested with fluke to a greater or less extent. Supposes that not more than 5 per cent. are free from fluke; but it rarely prevents their growing and fattening.
	Tumours	...	Cattle occasionally die from tumours, generally about the neck or head. Tumours full of yellow matter.
5 ...	Foot-rot	1 per cent.	Much trouble with foot-rot after wet winters.
	Fluke	3 per cent.	
6	...	...	Says he has one beast he supposes suffering from phthisis.
Benalla:			
7 ...	Fluke	5 per cent.	Lost 20 per cent. from fluke in six months. If well supplied with salt the loss is estimated at 5 per cent. if the sheep are not kept more than one year on the station.
	Poisoning ...	1 per cent.	
8 ...	Fluke	5 per cent.	
	Poisoning ...	3 per cent.	

9	Fluke	7 per cent.	Principally aged sheep.
10	None	...	Shifts his sheep about to avoid floods, and thus has no disease.
11	None.		
12	Unknown disease	Over 50 pr. ct.	One thousand lambs were alive at shearing out of the total increase of 6000 ewes; and out of 1500 sheep 700 only were alive. Supposed to be from denseness of timber, especially the wattle. Lambs become affected as soon as they are able to eat, lose condition, and grow big in the belly. After death two little black lumps are found sticking to the back near the kidneys. Over all the hilly country on the Goulburn the increase is not equal to the losses, and the country will come to be abandoned.
13	Fluke	5 per cent.	
14 ...	Fluke, rot, foot-rot	...	Out of 2500 sheep the annual losses are—fluke, 100; rot, 60; foot-rot, 50; poisoning, 50.
	Pleuro, poisoning	10 or 5 pr. ct.	Horses healthy.
15 ...	Pleuro	...	Six or seven years ago the loss of cattle from pleuro was 50 per cent. No losses were experienced afterwards till last year, when 1 per cent. died.
	Fluke	20 per cent.	Annual losses from fluke in all the flocks, 20 per cent.
CASTLEMAINE:			
16	Pleuro	2 per cent.	Brought by working bullocks from a distance. At Torphicon (Korong), cattle on common seldom free from it.
GIPPSLAND:			
17	...	...	Unweaned calves affected in fore quarters; cured by bleeding.
GIPPSLAND, N.:			
18	Glandular swelling	...	Swelling of throat at root of tongue; not fatal generally.
19 ...	Pleuro	3 per cent.	Not troubled with pleuro except when he buys store stock.
	Poisoning.		
GIPPSLAND S.:			
20	None.		
21	Fluke, foot-rot ...	5 per cent.	No diseases amongst cattle. Says if he could burn off his grass he should have neither foot-rot nor fluke.
22	...	...	Buys cattle from New South Wales. If not inoculated, pleuro breaks out soon. Recommends rubbing with kerosene and firing as a cure. Inoculation regarded as a preventive merely.

Analysis of the whole Information—*continued.*

District.	Diseases.	Losses.	Remarks.
Gippsland S.:—*continued.*			
23 ...	Pleuro	...	Recommends rubbing with kerosene and firing for pleuro.
	Coast disease ...	...	Coast disease bad every year, but not fatal if the stock is removed from the sandy tracts.
24	Coast disease ...	...	Losses from coast disease were—1871, 1100; 1872, 840; 1873, 540. 12,000 sheep on 30,000 acres of sandhills. If left too long they get the disease. When removed to healthy plains they quickly recover. Fluke in the purchased sheep; none in the station sheep.
25 ...	Pleuro	...	Pleuro most destructive.
	Glandular swelling	...	Another disease with swelling of the glands of the neck. When lanced a quantity of matter is discharged. Abscesses form. Great difficulty in breathing; the noise often attracting notice. Sometimes they live for two or three years; but sometimes only a few months.
	Blackleg	...	Some cases of blackleg.
	Foot-rot	...	Very bad.
	Fluke	66 per cent.	From fluke lost last year 800 out of 1200 sheep.
Gisborne:			
26	Foot-rot	...	Foot-rot common and troublesome.
27	...	...	Pleuro eight or nine years ago, but none since. Inoculation approved of as a preventive.
28 ...	Fluke	31 per cent.	No foot-rot. Pigs running wild are affected with fluke. Salt and sulphate of iron given in large quantities.
	Poisoning ...	5 to 6 per ct.	Poisoning occurs in the spring.
Grant:			
29 ...	Foot-rot, fluke ...	3 per cent.	Fluke constantly found in the livers of sheep; but they do not seem to be injured in health or appearance.
	Rot or dropsy ...	25 per cent.	Rot or dropsy fatal.

MELBOURNE:			
30	None.		
31	Pleuro	10 per cent.	In northern cattle purchased, if not inoculated, 20 per cent. die. Inoculation believed to be a preventive.
	Fluke and rot	50 per cent.	
	Hydrothorax	A few	A few die from hydrothorax.
	Consumption	A few	A small percentage from consumption.
			Rheumatism prevails from east side of Port Phillip Bay to Sherwood. There was blackleg at Dandenong in 1845, none since. Cattle are infested with fluke. Romney Marsh sheep die from diarrhœa.
32	Pleuro, rot		Bones of animals break easily.
OMEO:			
33	None		Complains of native dogs and eagles. Had to sell sheep, and stock with cattle.
PORTLAND:			
34	Coast disease	500	Deaths from unknown cause, coast disease, and poisoning. Fluke for the last three years. Loss—500 annually from coast disease; 1400 from fluke. Fluke on the increase.
	Poisoning		
	Unknown		
	Fluke	1400	
35	Fluke	10 per cent.	Swampy run. Salt and iron given with good effect.
	Foot-rot		Foot-rot once very bad; cured by arsenic. Returned last year; nearly got rid of again. Wild dogs destructive.
36	Pleuro	10 per cent.	
37	Coast disease	10 per cent.	Sandy, scrubby run. A quantity of sand hardens in the intestines. Horses and cattle get the same disease, but less severely, as they get food in the swamps. Coast disease is quite different from this.
SETTLED:			
38	None.		
39	None.		
40	Foot-rot		Very bad; recommends bluestone.
	Fluke		Fluke has appeared amongst sheep bought last year.
	Poisoning		Thirty-eight out of 4000 died from poisoning. Much swollen, and die in twelve hours. Flesh turns green and putrid. Those that recover lose their fleece. Recommends as a cure for pleuro "driving them about" as fast as they can be driven by a man on horseback.

Analysis of the whole Information—*continued.*

District.	Diseases.	Losses.	Remarks.
Settled—*contd.*:			
41	Fluke	...	Great losses from fluke. Salt and dry ground near the sea do not cure the sheep, but thinks those bred there will not have the disease.
Swan Hill:			
42	None.		
43	None	...	Poisoning occasionally, but very rarely, among sheep only.
44	Glandular swelling	...	No disease amongst cattle, except swollen jaws A good many cases, chiefly amongst store cattle purchased. Seems to commence with inflammation of the opening of the windpipe, and then an abscess forms. If this breaks the beast may recover, if not, he dies.
45	None.		
46	None.		
47 ...	Pleuro	3 per cent.	Thinks this disease is constantly imported from New South Wales.
	Foot-rot	Troublesome	Fluke comes also from the eastern districts of New South Wales.
48	None.		
49	None	...	Recommends keeping goats along with cattle.
50	None.		
51	None	...	Says that pleuro-pneumonia was first brought to the Loddon district by cattle dealers from Sandhurst.
Warrnambool:			
52 ...	Fluke	20 per cent.	
	Foot-rot	5 per cent.	
53 ...	Fluke	4000 ...	Foot-rot very bad.
	Foot-rot	...	
Western:			
54 ...	Foot-rot	...	A great scourge ; 50 in 3000 die.
	Fluke	...	Sixty in 3000 from fluke. No disease in cattle. Run wet and heavily timbered, with many swamps and marshy gullies. Cross-bred sheep less subject to fluke.

55	Foot-rot	...	Sheep subject to foot-rot.
	Consumption ...	1 per cent.	About 1 per cent. die from consumption. No pleuro for two years amongst cattle. No fluke. There are salt lakes on the station.
WIMMERA:			
56	...	...	Some pleuro in a milder form. Recommends inoculation. Fears flukey sheep being brought from other districts, and suggests that the scab inspectors should give permission to travel to sound sheep only.
57	...	...	A little foot-rot. No other disease.
58	None	...	Pleuro about two years ago amongst purchased cattle, but it did not spread. Any cases of foot-rot or fluke were amongst purchased sheep.
59	None	...	No disease amongst sheep, cattle, or horses.
WIMMERA, W.:			
60	Worm disease ...	Small ...	This occurred two years ago. Nothing of the kind before or since.
61	Diseases unknown	2 per cent.	Some foot-rot formerly; but country having become sounder, the disease has now ceased. Losses 2 per cent., but causes not known.
62	Fluke	4000 ...	The disease supposed to have been brought to the district by the selectors' stock within the last two years.
63	None.		
64	None	...	Has heard that selectors have brought flukey sheep to the Wimmera from the Hamilton district.
65	None	...	Pleuro some time ago; none now.
66	None.		
67	None.		
68	None.		
69	Blackleg	1 per cent.	
	Fluke	4 per cent.	
	Poisoning ...	1 per cent.	
70	None	...	No disease at any time.
71	Pleuro	1 per cent.	
	Foot-rot	...	Very little foot-root.
	Poisoning ...	...	Very few from poisoning.

ORANGE CULTURE.

By Mr. Josiah Mitchell.

The orange is one of the most beautiful and most profitable of fruit-bearing trees. Whether viewed when covered with fragrant snow-white blossoms, or when laden with golden globes of delicious juicy wholesome fruit, it is an object of rare beauty. Even as an ornamental plant alone the orange richly merits a place in every garden throughout the colony where the frosts in winter are not so severe as to seriously interfere with its growth. It is not, however, my present object to descant on the numerous beauties of the orange plant, but rather to make a few remarks on its culture as a most valuable fruit-bearing tree. Cultivators who must eat bread by the sweat of the brow cannot afford to indulge in love of the beautiful alone. Fortunately, the orange combines worth and beauty. In every part of the world where the climate is warm enough the orange plant is carefully cultivated. Concerning the qualities and the various uses of its fruit little need be said. No fruit is more widely known, more highly esteemed, or more largely consumed. Old and young, rich and poor, those who are in robust health as well as those who are suffering from disease, all enjoy the brisk, sweet, yet slightly acidulated, wholesome, and delicious juice of the orange, and all are benefited by the cooling, refreshing, and blood-purifying properties it possesses. Hence, in every country where they are procurable, oranges may be found on the dessert tables of the wealthy and middle classes, in the sick chambers of invalids, and in the hands of children. Indeed, such is the general demand, and such the marvellous capacity of children for devouring oranges, as to render it extremely hazardous to predict the possibility of a glut. In Britain alone the consumption of oranges considerably exceeds a million bushels annually. This large supply is obtained from the Azores, Malta, Sicily, Spain, and Portugal, where the orange is extensively cultivated, and its fruit constitutes an article of great commercial importance.

Oranges are largely consumed in this colony, and our supply is derived from New South Wales, where they are grown chiefly in the neighborhood of Parramatta. Through the persevering industry of our fruit-growers, our markets are now well supplied with all the kinds of fruit commonly cultivated in Britain, and we are almost, if not entirely, independent of supplies from Tasmania. Possessing, as we do, in several districts of this colony both the soil and climate suitable for the growth of the orange, there is no reason why we should continue

dependent on New South Wales for the needful annual supply of this necessary fruit. Under favorable conditions, the cultivation of the orange is just as simple as is that of the apple or any other fruit-tree, and far more profitable.

Mr. D. C. Macarthur was the first to test and publicly illustrate what might be done in the way of cultivating the orange in Victoria. Others followed his example—notably Mr. John Carson, who during many years has grown and exhibited fine specimens of oranges at the meetings of the Horticultural Society. Gradually the number of orange-growers on a small scale increased. Experience has accumulated, until now there can be no doubt but that, under proper management, the orange may be grown with profit in many districts around Melbourne, and also in the neighborhood of Wangaratta. Other districts will yet be found suitable for the cultivation of this valuable fruit; and of its great value, few except those who are the fortunate owners of orange groves in full bearing have any true conception. At Mount Pleasant, near Parramatta, in 1870, I saw a crop of oranges on five acres of Mr. H. Pearce's orchard for which the sum of £2000 had been offered and refused. The crop was estimated, by gathering the fruit of an average tree, at 10,000 bushels of oranges to the acre! In the same year Mr. James Pye, the father of orange-growers in New South Wales, showed, at the Sydney Exhibition, a section 21 inches in diameter, taken from the stem of an orange tree forty years planted, and along with the section a statement that during twenty years the tree had produced for him 300 dozens of oranges annually. Moreover, if proof were wanting, the annually increasing area of land devoted to orange growing in the Parramatta district affords abundant evidence that the industry is a profitable one. No fruit stands packing and carriage to market so well as the orange, and few, if any, will yield so large a return for outlay and attention bestowed on careful cultivation.

Hitherto the orange in this colony has been grown in only small experimental patches. In this way sufficient experience has been gained to justify more extensive operations. Where the conditions have been found suitable, orange groves, it may safely be predicted, will ere long be planted. To those who may contemplate planting on an extensive scale I would commend the following remarks on the cultivation of the orange, based mainly on the now nearly sixty years' experience of Mr. James Pye, the oldest, and, I may add, the most successful orange-grower in New South Wales.

Site, Aspect, and Soil.—In the Parramatta district, from which our supplies of this fruit are obtained, the orange tree may be seen

growing under a great variety of conditions. The sites and aspects of orange groves differ as much as do the soils, and these vary from poor sands to strong clays. The best site is that of a gently-sloping hill, and the best aspect a north-eastern one, which will catch the first rays of the morning sun. Shelter from cold and violent winds is an indispensable requisite, and no plant is more grateful for shelter than the orange. At St. Michael's, one of the Azores, where oranges constitute the staple product, the ground is divided into areas of about 200 feet square, surrounded by dry stone walls from 12 to 20 feet high, for the purpose of affording the necessary shelter. The best soil for the orange is a free slightly sandy loam, naturally and thoroughly drained, resting on a sound healthy subsoil, and containing such an abundance of vegetable matter as will enable it to retain moisture in summer. By careful attention to surface manuring, the orange may, however, be grown in poor, if healthy and well-drained soils.

Preparation of the Soil.—The ground should be ploughed and subsoiled in the spring, well worked as a fallow through the summer, and in the following spring ploughed into lands 20 feet wide, and harrowed ready for planting. Much of the future success of the young orchard will depend on the thorough and careful preparation of the soil, therefore no pains should be spared to bring it into a fine mellow and thoroughly incorporated condition.

Plants and Planting.—The intending planter should procure his plants fifteen months before he is ready to plant them out permanently. For example, the plants intended to be planted in the spring of 1876 should be obtained in April or May 1875, and while the ground is undergoing preparation the young plants should be grown in a prepared bed of sandy soil, containing a moderate admixture of vegetable matter. This bed, in which the plants may stand a foot apart, should be surrounded by a rough frame of wood, and furnished with a calico shade on rollers, so that the young plants, which should be carefully watered, may be duly protected from all extremes of cold and heat, care being taken, however, to promote a hardy, healthy growth, and to secure well-rooted, rather grossly-grown plants, for planting out. Seedlings of the Seville make the best stocks on which to graft other varieties, and are used as such by Mr. Pye. One-year old plants will be the cheapest and the best for the intending planter. In order to secure care in packing, and accuracy of naming, it would be advisable to deal directly with some respectable grower. The ground and the plants being in readiness, spring is the best season for planting, that is, the latter part of the month of August. If the young plants have been properly cared

for, they will be well-rooted, and being on the spot, suffer but little from careful transplanting. When planted, the young trees should stand 20 feet apart each way and opposite each other in the rows. Watering and mulching the surface with half-decomposed farm-yard manure within a radius of two feet around the newly planted plants will complete the operation. No blanks should occur in an orchard carefully planted as above described. The after management of the orange grove, as regards ploughing, scarifying, and so forth, will be the same as though apples or any other kind of fruit-trees had been planted, namely, preventing the growth of weeds and keeping the surface mellow and free. Planting the trees opposite each other lessens the cost of keeping orchards, by reducing hand labor to the squares on which the trees stand.

Pruning.—The orange is impatient under the knife, therefore pruning is strictly limited to keeping the centre of the tree free from the accumulation of spray and small useless branches—which, if not removed, would prevent the free circulation of air through it—and removing or shortening back strong-growing shoots which threaten to destroy the balance and the beauty of the plant.

A well-managed orange tree will be cone-shaped, branched to within two feet of the ground, and resembling in fact a pine-apple with its green crown removed.

General Management.—In the general management of an orange grove, digging, or even using the draw hoe, should be scrupulously avoided around the plants as far as the roots extend. The Dutch or push hoe is the only implement that should be used for raising a loose layer of soil or stirring the mulching to a depth of about an inch above the surface roots. Stirring the soil to any greater depth destroys these roots, and seriously interferes with the health and well-doing of the plant. The use of the plough will of course be limited to the space between the rows to which the roots of the plants have not extended. Allowing very young plants to bear fruit is a common error with the experimental orange-grower, and should be carefully avoided by those who desire to rear healthy, vigorous, and durable trees. Properly treated, duly manured, and not overborne, the orange will continue to bear large crops of fruit during many years. The prudent cultivator regulates the crop in accordance with the strength and vigor of the tree. Bearing in mind, too, that the fruit grown on young plants is thick in the rind, he abstains from producing large crops of comparatively valueless fruit, to the serious detriment of his young plants.

The fact that young orange plants bear thick-rinded fruit has, in my opinion, tended to retard the extension of orange culture in this colony. The climate has been blamed for producing an undesirable quality in the

fruit, which was entirely due to the youth of the plant. Yet, fruit as thin-skinned as any grown in New South Wales is produced by those trees which have attained to a sufficient age. In point of flavor too the oranges grown at Kew, Gardiner, Toorak, and other places compare favorably with the imported article. Indeed, there is no reason why we should not grow an ample supply of oranges for our own use. Given the climate and soil—and these we have—the cultivation of the orange is as simple as that of any other fruit-bearing tree. The main points requiring attention in the cultivation of this most desirable fruit are—

(1.) A healthy well-drained soil.
(2.) Shelter from cold and high winds.
(3.) Scrupulously to avoid injuring the roots by digging, ploughing, or hoeing.
(4.) Keeping the centre of the plant free from useless spray.
(5.) Avoiding over-cropping ; and
(6.) Surface manuring, to maintain the plant in healthy vigor.

After the plants have been planted, no spade or fork should ever be used among orange plants, and injury to the roots should be carefully guarded against. Well decomposed stable dung spread on the surface in autumn, or Peruvian guano judiciously applied in showery weather, when the plant is making its growth, will be found the best means of sustaining the orange tree in vigorous healthy bearing condition. Care, however, must be exercised in the application of these fertilizers, so as not to produce over-luxuriance by their too liberal use. In dry seasons, and under circumstances where a supply of water is not available, mulching the surface with fresh strawey stable dung will act as a preservative of moisture in the soil if applied early enough, that is, before the ground has become too dry. A few years since it was supposed that our climate was unfavorable to the growth of the strawberry, except the old flavorless White Carolina ; but now our markets are abundantly supplied with well-grown samples of numerous excellent varieties—many of which are seedlings raised in the colony—of this delicious summer fruit. Like successful results will be achieved, I have no doubt, when our fruit-growers turn their attention to the culture of the orange tree.

The insect pest to which the orange plant is most subject is the Brown Scale, or "sooty blight;" but this, by the timely use of Gishurst's compound, or soft soap and tobacco-water, may be kept within bounds, and prevented from doing any serious mischief.

As regards the districts in which orange groves may be established and the orange profitably cultivated in this colony, I have long been of

opinion that many suitable sites may be found to the eastward of Melbourne, in the Gardiner's Creek district, and also in the neighborhood of Wangaratta.

The following varieties of the orange have been found to succeed well where they have been planted and properly cared for in the Melbourne district :—

The Navel.—This variety perhaps requires a greater degree of warmth to bring it to perfection than is to be found in the neighborhood of Melbourne, but may succeed well around Wangaratta.

Parramatta Seedling. — An excellent and free-bearing variety, yielding abundant crops of handsome medium-sized fruit.

St. Michael's.—Fruit medium size, thin skinned, with dark-colored pulp. A capital variety.

The Maltese Blood grows well, yields good crops, and is a desirable variety.

The Teneriffe, like the Maltese Blood, succeeds well and bears freely.

The Poor Man's Orange bears fruit of very large size, but, like the Seville or bitter orange, is better adapted for the purpose of making marmalade than for use as a dessert. The tree is a free bearer, highly ornamental, and on the score of its beauty alone is deserving of a place in every garden.

The Mandarin, or Chinese Orange, is small leaved, of handsome and compact habit, a free bearer, and highly esteemed for its sweetness and peculiar aromatic odor.

The Seville, or Bitter Orange, is extensively used for making marmalade ; it is also frequently candied, and in that state constitutes the well-known "orange peel" sold by grocers. This variety thrives well and bears freely wherever it has been tried in this colony.

In addition to the foregoing, many other varieties and several excellent seedlings, raised by Mr. James Pye, are grown in the New South Wales orange groves, besides the Lisbon Lemon, the Shaddock, and the Lime, all of which will, I have no doubt, be turned to profitable account ere long in this colony.

THE CULTIVATION OF THE HOP IN VICTORIA.

By the Secretary for Agriculture.

INTRODUCTION.

The hop is among the most useful and remunerative, at the same time the most precarious of farm crops, giving at times large and profitable returns, and at other times not, or barely covering expenses. Hops are extensively grown in the south-eastern and west midland counties of England, and also in Bavaria, Würtemburg, Belgium, France, and the United States of America. They are used for preserving and imparting a peculiar bitter to beer. The only portions of the plant which possess these properties are the seeds and the yellow glutinous matter which surrounds the outer integuments of the seed, and lies at the bottom of the petals. This yellow matter emits a delicate and agreeable aroma, which is extremely volatile, and has an intensely bitter taste. Hops require very careful treatment during the process of drying, and should be closely packed as soon as possible after the drying is effected. New samples are always more valuable than old ones, as hops lose much of their aroma when kept over one year. By means of an air-tight "refrigerating chamber," hops may be preserved for a long time without deterioration. A brewer of Albany, New York, states that he put twenty-four bales of New York hops in one of these chambers, 15th February 1869. They were examined several times during the ensuing summer, fall, and winter, without exhibiting any loss in quality. A portion of these hops used during the winter of 1869–70, showed no change of color, and proved in every respect equal to the new crop.* Hops are imported into this country in large quantities, from England and Tasmania, and realise prices in the Melbourne market varying from 1s. 8d. to 2s. 4½d. and 1s. 3d. to 1s. 10d. per pound respectively. During the past few years, somewhat extensive plantations have been formed in Gippsland and other parts of Victoria; and year by year the produce of these plantations is becoming better known and appreciated, but the prices realised in the market are still in arrear of those obtained for imported samples. The hop is a plant deserving extensive cultivation in Victoria, and one for which the soil and climate of a vast area of our territory is pre-eminently adapted. With a view to give an impetus to the raising of this crop, and to place reliable information regarding its cultivation before intending growers, this department issued a circular to the principal hop-growers in those

* Report, United States Department of Agriculture, 1870, page 449.

districts of Victoria where this plant has been introduced and cultivated, tending to elicit answers to the following queries :—

1. By whom was the hop-plant first introduced to your district, what is the date of its introduction, and where was it first cultivated?

2. Please state what kinds are principally grown, making special mention of those which have proved best adapted to the district.

3. In this country, what character of soil do you consider the best for a hop-plantation, and what the best aspect?

4. What mode do you recommend for forming a new plantation?

5. What system of drainage, if any, have you adopted; and does your experience teach you that a proper system of drainage is essential to the healthy growth of the hop in Victoria?

6. Do you approve of irrigation where practicable?

7. What distance apart, in your opinion, should the hills be placed?

8. Do you approve of planting upon the square or the triangular system?

9. What system of raising cuttings do you adopt? Please state whether you bed out your cuttings in the spring before permanently planting them?

10. What care do you bestow upon the distribution of male plants throughout your hop-yard? Please state how many of such plants you consider necessary for the proper fertilization of the hops upon one acre.

11. Give brief particulars of the system of cultivation which you adopt, making such particulars extend over one year.

12. What, according to your estimation, is the average cost of cultivation per acre?

13. What the average cost of stakes per acre?

14. How do you store your stakes during winter?

15. What manures, if any, do you use? When and in what quantity per acre do you apply the same?

16. What, in your opinion, is the average value of the various kinds grown in your locality?

(1) As regards quality.

(2) As regards yield per acre.

17. Do you experience much difficulty in obtaining labor during the picking season?

18. Do you effect the picking by piecework; if so, what do you pay per bushel or per sack, as the case may be? Under what circumstances are such prices liable to variation?

19. Have you noticed much disease among your hops; if so, what is the nature thereof? Please forward specimens of diseased plants for examination and report, and if you have observed any insects or grubs attack the plant send specimens of them likewise.

The replies received to the above queries, it is gratifying to relate, are of the most lucid and intelligent nature, and the persons who have supplied the information are deserving of all praise for their generosity in giving to the public the results of their practical experience, and for their promptitude in replying to the circulars.

Introduction of the Hop-plant.—The hop, it would appear, was first grown in Victoria as a farm crop by Mr. William Manly, at Elmhurst,

on the banks of the Glenpatrick Creek, about the year 1864. It seems then to have been introduced into Gippsland by Mr. A. Barton, who planted a few acres at Strathfieldsaye, on the shores of Lake Wellington, in the year 1867; and subsequently hop-grounds were formed at Bairnsdale, by Mr. A. W. Howitt, P.M., Mr. F. W. Blyth, Mr. A. W. Macleod, Mr. Philip Redenbach, Mr. Hoskins, and Messrs. Ballantine and Morrison, and Ballantine and Webb; at Briagolong, by Mr. M. Landy and Mr. Michael Feely; and at Glenmaggie, near Maffra, by Mr. Peter Ferguson. The hop has likewise been successfully cultivated by Mr. J. Henly, at Oxley, in the North-Eastern district; by Mr. H. Phillipps, at Bryan O'Lynn, near Warrnambool; by the Board for the protection of the Aborigines, under the superintendence of Mr. Burgess, on the Coranderrk station, in the Upper Yarra district; by Mr. George Miller, in the Berwick district; and by Mr. Judson, on the Kangaroo Hills, near Kingston.

Varieties.—Goldings, the Early grape and Late grape, appear to be the kinds principally grown, and found to be best adapted for cultivation in Victoria. Mr. Manly mentions the red bine* as the variety growing in his hop-ground. Mr. F. W. Blyth has planted goldings and early and late grapes, but considers the goldings to be the best, and the early grape to be quite unsuited to the climate of Bairnsdale and its vicinity. Mr. Howitt prefers goldings. He states—

"An early variety has been selected by Mr. Burgess from my plantation, the name of which is unknown,† but which has, in Melbourne, been referred to the Bavarian Spalt hop as the nearest kind in quality."

Selection of Site.—In Victoria rich alluvial river-flats, having a great depth of soil, and being naturally well drained, or lands which permit of irrigation, have generally been selected for hop-plantations; but no regard appears to have been paid to aspect. The chief circumstance which has guided intending growers in the selection of a site has been protection from prevailing winds; and in those districts of Gippsland where the hop has been cultivated, perfect shelter from the north, west, and south-west winds is deemed indispensable, the north wind being generally recognised as the most prejudicial. Shelter can usually be obtained by leaving belts of timber standing; but where it is necessary to produce an artificial break-wind, the poplar will be found the best tree for giving a rapid and efficient shelter in a moist climate like that of Gippsland. A mistake, which unfortunately has been made too frequently, is the planting of hop-gardens on the lowest parts of river-flats, instead of at a point above flood-level, and this has caused

* Probably goldings.

† Mr. Burgess has called it the "Early white bine." It has proved to be a valuable variety at Coranderrk, on the Upper Yarra.

hop-growers to sustain much damage, which otherwise might have been evaded.

Preparation of Land.—In preparing land for hops the chief matters to be observed are, firstly, if the land be timbered, to rid it of all encumbrance; and, secondly, to plough and subsoil, where practicable, to a depth of from two feet to two feet six inches. The land is first ploughed in the ordinary way to a depth of from nine inches to one foot, and the subsoil-plough follows in the furrow and breaks up the subsoil to a depth of from fifteen to eighteen inches more, where subsoiling is possible and requisite. In some cases a liberal dressing of farm-yard manure and bones is given, but this will not be necessary in cases where the land is virgin soil and naturally fertile.

Drainage.—Proper drainage is essential to the healthy development of the hop-plant. As a rule, no system has been adopted with us, except surface-drains to carry off flood-water; but in selecting sites for hop-grounds persons have been careful to select only those in which the drainage is naturally good. Hops will not thrive in land which has a wet or cold clayey subsoil, and, where such exists, a thorough system of drainage must be adopted.

Irrigation.—Where practicable, irrigation is generally deemed to be beneficial, more particularly where the soil is porous, and admits a rapid percolation of water. In moist cool localities, however, except in seasons of great drought, it will not be necessary to irrigate the hop-ground, the rain which falls being usually sufficient for the requirements of the crop. Hops, it is said, are not injured even when covered with water for a few days, during the continuance of a flood. When newly planted, however, irrigation will destroy them; and floods, shortly after pruning, will likewise do them much harm.

System of Planting.—The square system is generally admitted to be the best upon which to lay out and plant a hop-ground; and it is thought desirable that there should be at least seven feet between every hill. Some growers, however, prefer to place the hills eight feet apart, while others again think six feet sufficient for the smaller varieties. Planting on the square permits of a more perfect and free use of the horse-hoe, which is most essential for the keeping down of weeds during the spring and summer months, reduces the area on which hand labor is necessary to a minimum, and enables the grower to conserve moisture in his land by maintaining a loose layer of soil on the surface.

Sets.—The practice of crowding as many plants as possible into an acre is exploded. Two good sets are usually deemed sufficient to form a hill; some growers, indeed, plant only one. A diversity of opinion prevails as to whether crown sets or bedded sets are the best

to plant; but the balance of evidence is in favor of using crown sets, and planting them out at once when forming new grounds.

Male Plants.—These should be carefully distributed throughout a plantation, as upon their presence and influence, to a vast extent, depend the quality of the hops grown. A difference of opinion exists as to the number which are necessary for the proper fertilization of the hops upon one acre. Some growers consider one, others two, and others three per cent. needful; but the number will be regulated by the manner in which the plants are distributed. If advantage be taken of the prevailing winds for the dispersion of the pollen, and some of the plants be placed upon the borders across which these winds blow, and others are distributed at regular intervals throughout the plantation, two per cent. will be found sufficient.

Cultivation.—The hop demands careful management during the whole period of its growth. The entire system of cultivation, as practised in Victoria, has been admirably described by Mr. F. W. Blyth and Mr. W. Manly, and it will be requisite only to publish their remarks in order to give a full account of the cultivation and management of this crop in two widely removed districts. Mr. Blyth, writing from Bairnsdale, in Gippsland, details the system of cultivation as follows:—

"When the ground is prepared and rolled, measure it off with a Gunter's chain, and place reeds at the required distances; this can be done so exactly that the rows may be seen in many directions. Plant the sets or cuttings so that they are covered with about one inch of soil, taking care to plant the right end upwards. This should be done in September, and the ground kept quite free from weeds till the end of December, after which the hops will smother them. In the September following prune carefully, dig with a fork round each plant to a depth of eight or nine inches, and also dig or plough both ways between the rows. Pruning is one of the most important operations. Care must be taken *not to cut off the head;* at the same time it ought to be trimmed very close, or too many eyes will sprout. All runners and surface roots should be cut away; and, after pruning is completed, the plant should be covered with soil to a depth of one to one and a half inch, raised in the form of a cone. Poling is the next operation, and should be finished by the middle of November. The poles should be about seventeen feet long,* and placed in the ground one inch for every foot in length, and should diverge at the top, otherwise the bine masses at the summit, to the exclusion of air and light; both of which are essential to the healthy growth of the plant. Three poles are required for each hill, and may be placed deeply and securely in the ground by the aid of an iron bar. Tying comes next, and forms an important part of the work. I should recommend not to tie the first bold shoots, but to pull these off for about a month, and wait for more wiry ones.† Discontinue tying at Christmas,

* The length will vary with the kind of hop grown.

† Mr. D. Ballantine agrees with Mr. Blyth in this particular. He writes—"When the crowns begin to shoot, skilled supervision is necessary to select those shoots which promise to be fruitful, discarding the gross and succulent, and leaving (say) six or nine of the tough and smaller ones. Tying follows when these are sufficiently long to wind round the pole once or twice. The bine, as is well known, will climb one way only, viz., from west towards east."

except in the case of plants that get blown down, which should be attended to with a step-ladder. No pole should be more than from three to three and a half inches in diameter at the thick end; for unless the ground be very strong the bine will not climb so well. The scarifier and hand-hoes should be kept freely at work till January, as it is very important to keep the ground loose and free from weeds. By being thus treated, the soil is enabled to retain a higher percentage of moisture. All runners should be pulled off in December and January, but *no leaves or lateral branches near the ground removed.* Some growers pull or cut off everything to a height of five or six feet; but my experience tells me that this bleeds the plant and injures it. Hill the plants up in December, to about four inches, in a conical form. Picking commences with us about February."

Mr. W. Manly gives the following account of the system of cultivation practised in his hop-ground at Elmhurst, in the Ararat district:—

"About the middle of August, the hills are opened out with a fork, and all runners cut off close to the crown. Some fine mould is then scattered over the crown; and when this is done the hills are poled, four poles being placed to each hill. The poles should stand about one foot apart, and incline a little outwards from the perpendicular to prevent the bines matting at the top, to the exclusion of air and light. As soon as the hops begin to shoot, they are tied to the poles with rushes, great care being necessary, as the bine, at this period of its growth, is very tender, and if broken will run no further, but must be pulled up and a fresh one trained. Two bines are enough to train up each pole. A greater number makes too much foliage, to the sacrifice of hops. At all times when necessary the horse-hoe is passed through the hop-yard in every direction, making a fine tilth and keeping down weeds. No other kind of cultivation is required, as the horse-hoe can be set deep or shallow at pleasure, and any spots missed can be looked over afterwards and finished with one of Parkes' steel digging forks. All superfluous runners are next pulled out,* and a little mould is then thrown over the hill. As soon as the hops reach the top of the pole, which they will do very quickly under favorable conditions, nothing more is required until picking time but to keep down the weeds. When the hops are ready for picking—which may be known by the scales opening and showing the yolk (a yellow powder which lies at the bottom of the scale or petal), being easily removed, and on being rubbed in the hand giving out a delicate aroma and feeling sticky to the touch—a piece of canvas is stretched across two poles fixed about two feet six inches from the ground, and being sufficiently large to allow ten or twelve pickers to stand round it. A man with a strong pole for a lever and a chain then proceeds to cut the vine about eighteen inches from the ground, and, fixing the chain round the pole and near to the bottom, lifts it out with the lever and places it over the canvas sheet, that the pickers may pick off the hops, which they let fall into the sheet, keeping out leaves and stalks as much as possible. When all the hops are picked off, the pole is removed and a fresh one put in its place, and so on until all are picked."

Cost of Cultivation.—This is variously estimated at from £25 to £50 per acre. Mr. D. Ballantine calculates that, with a crop of half a ton per acre, the cost of growing and sending the hops to market amounts to 9d. per lb., or £42 per acre. Mr. F. W. Blyth considers £25 per

* When about six inches long, hop runners are equal as a vegetable to asparagus.

acre sufficient to cover expenses, exclusive of poles. Mr. Manly gives the following estimate of the cost of cultivation :—

	£	s.	d.
"Dressing hills, poling and providing new poles when required ...	8	0	0
Tying, weeding, and keeping down shoots	9	0	0
Picking by women and children, at 2s. per day, and found	28	0	0
Bags and bagging	5	0	0
	£50	0	0"

The *Australasian* newspaper of the 4th April 1874 contains the following information on the subject :—

"In a recent issue of the *Australasian* a desire was expressed to see the items of which the sum of £50—the estimated annual expenditure of hop culture per acre—was made up. The matter, it was suggested, might form a useful subject for discussion, and the event has more than justified the remark. Our contemporary, the *Mercury*, has already been enabled to publish two statements by different growers, which give a capital insight into the kinds of labor which go to make up the year's work on a colonial hop-ground. The first is the estimated cost of an acre of hops, supposed to yield 1680 lbs., or 15 cwt. :—

"'ONE ACRE.

	£	s.	d.
Picking, including labor for drying, at 2d. per bushel	14	0	0
Taking down bare poles, 2s. 6d.; stripping off bines, 7s.	0	9	6
Taking old poles and bines off the ground, or burning them	0	5	0
Fresh pointing and stacking poles	1	0	0
Twelve hundred new poles, delivered, pointed, and carted into the hop-ground, at 12s. per hundred	7	4	0
Laying out poles preparatory to poling	0	7	0
Manuring	3	0	0
Digging	2	0	0
Opening out hills and pruning	1	0	0
Poling	1	0	0
Tying	2	5	0
Horse-hoeing	1	15	0
Hoeing round hills and hilling up	0	5	0
Putting up broken poles destroyed by wind	0	15	0
Pole-pulling for pickers	1	0	0
Charcoal, 60 bushels, delivered, at 5d. per bushel	1	5	0
Seven new bales, at 5s.	1	15	0
Pressing seven bales, at 2s. per bushel	0	14	0
Loss, wear and tear of bin cloths and green bags, and repair to bins	0	8	0
Labor, irrigating	0	12	0
Carting seven bales to steamer	0	10	0
Freight to Hobart Town, 2s. per bale	0	14	0
	£12	3	6

"In furnishing this account the writer says :—

"'Of course it is only approximate; in a heavier crop the expenses would be greater, whereas in a lighter crop not so much. I believe those that cultivate their hops well cannot make their expenses much less than what I have stated in my list, and some will go beyond. You will perceive I have not included expenses for commission and freight to any of the other colonies, with duty, &c., which will come to a little over 5d. per lb. if you send out of the colony, which you are compelled to do, or take a very low price, as the consumption is so small in Tasmania.'"

"The next is a statement of the actual cost of cultivating six acres of hop-ground for the year 1872–3 :—

"'SIX ACRES.

	£	s.	d.
Stripping, at 5s. 3d. per acre	1	11	3
Burning off, 2s. per acre	0	12	0
Slacking poles, 5s. 3d. per acre ..	1	11	3
Digging, £2 8s. per acre	14	8	0
Dressing, 18s. per acre	5	8	0
Laying down poles, 5s. 3d. per acre ..	1	11	3
Setting up do., 15s. 9d. per acre ..	4	14	6
Tying, £2 5s. per acre	16	8	0
6000 new poles, 14s. per 100	42	0	0
Pointing do., 1s. per 100	3	0	0
Pointing old poles	1	10	0
100 loads of dung, at 4s.	20	0	0
Bone-dust, 1 ton	8	0	0
Horse and hand hoeing	3	0	0

	£	s.	d.
Repairing damage by winds	3	0	0
Cost of two irrigations	6	0	0
Two pole-pullers, at 24s. a week ..	7	4	0
Picking 12,458 bushels, at 2d.	103	18	0
Drying and pressing	30	0	0
68 packs, at 5s. 6d.	18	14	0
Charcoal and coal	9	10	0
Sulphur and twine	3	0	0
Freight to Hobart Town	8	10	0
Dumping	8	10	0
Wear and tear of tools, and omissions	5	0	0
Overseer	5	0	0
	£332	0	3

"'About £55 per acre.'

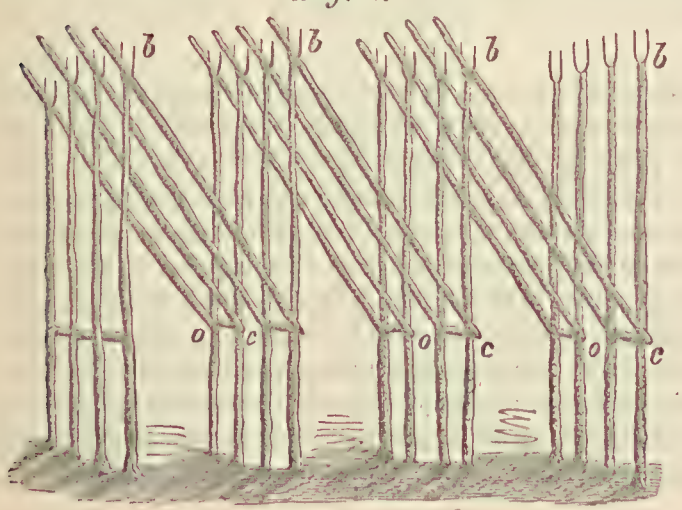
"The grower who supplies this adds :—

"'The crop of this year was unusually large, being close on 24 cwt. to the acre. If it had been one-half, or 12 cwt. per acre—which is about the usual average of the district—the cost of production under the items of picking and subsequent processes would have been reduced by the sum of £90, making the whole expenditure only £242, or about £40 per acre. I see no prospect of reducing the expenses of hop-growing except by the general adoption of Coley's system of poling, and by the farmer rearing his poles in the vicinity of his grounds.'"

The following description of Mr. Coley's vinery system of poling hops, and annexed woodcut, are taken from Mr. Whitehead's paper on "*Recent Improvements in the Cultivation and Management of Hops*," which is published in the *Journal of the Royal Agricultural Society of England*, 2nd series, vol. vi., part ii., p. 348 :—

"Mr. Coley, of Maidstone,* invented a plan of training hops in 1868, which has been already largely adopted, and has many advantages. According to this plan, two stout thoroughly creosoted poles—16 feet or 14 feet, reduced to about 12 feet long—are firmly pitched to each hill east and west. These have at the point *b* in the annexed drawing two pieces of wire lashed to their tips, to form a fork to receive a diagonally-inclined pole of from 12 to 14 feet long, which rests at the point *c*, in a staple fixed to the upright pole of the opposite hill. A stout piece

Fig. 1.



COLEY'S VINERY SYSTEM OF POLING HOPS.

* See a pamphlet called "*The Vinery Principle of Growing Hops.*" By Mr. Coley. Published by West, Maidstone.

of wood, *oc*, is nailed to the uprights at each hill, to keep them firm. These uprights are fixtures; the diagonal poles are lifted out at picking time and stacked away for the winter, after a new method of Mr. Coley's; but there can be no reason why this expense should not be saved, by simply replacing the diagonal poles, when stripped of bines, in their resting places in the staples and wires. In Mr. Coley's system the evils of horizontal training are greatly modified, and the bine has congenial support to cling to. High winds do not damage the hops, and the plant being cut high does not bleed to any extent. Mr..Coley says in his pamphlet, writing of last year's crop (1869): 'In the early hops we picked at the rate of 1 cwt. 3 qrs. 4 lbs. per acre extra on the patented plan, and in quality worth 10s. per cwt. more than those of the same sort grown upon upright poles. In the Colegate ground, picked after a severe gale of wind, we found on the new plan 4 cwt. per acre extra; these were sold at £5 8s. per cwt.; those adjacent, of the same sort, grown upon the upright poles, fetched £5 2s. per cwt.'"

Poles.—The cost of poles constitutes a considerable item in the total expenditure of hop culture, and, in some instances, is vastly augmented by the want of an effectual method of protecting their ends from decay. In England the practice of *creosoting* or *dipping* hop poles has become almost universal. Mr. Whitehead, in the paper before referred to, writes—

"It may be fairly said that this is one of the most important improvements that have been made lately in hop cultivation, as by its operation the prices of large hop poles have been reduced at least 22 per cent., and of smaller poles 14½ to 15 per cent., during the last eight years, while in the same period the hop acreage has been increased by over 10,000 acres.* Taking every pro and con. into consideration, it is generally reckoned that where creosoting has been steadily persevered in for eight years, from 40 to 45 per cent. has been taken off the whole expense connected with the poling of hops."

The operation of dipping is very simple, and is thus described by Mr. Whitehead:—

"The poles are put upright into an iron tank of about 2½ feet to 3½ feet deep 7, 8, or 9 feet long, 3 or 4 feet wide, with a small furnace underneath it, and a scaffold round to keep the poles upright. The fixed tanks are far the best, as there is much wear and tear indispensable from moving the tank from ground to ground, or from farm to farm. As much creosote† is poured in as will cover from 1½ to 2¼ feet—according to their size—of the ends of the poles in the tank, with due allowance for boiling. The bark is previously shaved off from the ends of the poles, so that the boiling creosote may permeate through the pores and sap-vessels of the wood. It is better to dip poles when green than to bed them for a year before dipping, as less creosote is required; the cellular tissues being soft, and the vascular layers full of sap, the preserving composition is more easily driven up and distributed by the atmospheric pressure. The watery parts of the tissues

* These reductions and figures refer to the English market.

† Creosote is the residuum of gas tar, after the extraction of aniline, benzoline, &c., and varies much in quality, according to the coal used.

and sap are evaporated, the creosote takes their place, preventing decay from wet, air, and the attacks of insects."*

"The poles are left in the tank for twenty-four hours, during at least twelve hours of which time the composition should be kept well boiling. It should be made to boil again before the poles are taken out, or it will become viscous and adhere to the poles."

The price of creosote in the Melbourne market is from 1s. to 2s. per gallon.

In Gippsland, hop poles cost from £5 to £6 per 1000, or from £15 to £20 per acre, according to the length of the poles and the number used. In the Ararat district, Mr. Manly finds wattle poles the best. He states that they will last four or five years, and that he can get them delivered at 50s. per 1000.

The same method of stacking poles during winter is adopted in Victoria as that which is common in other hop-growing countries, viz., placing the poles in conical heaps upon the ground.

Manure.—Manure does not seem to have been applied to Victorian hop-plantations, except in a few instances, when rotted farmyard dung has been put on hop-grounds which have been seven or eight years under crop, and worked in with the horse-hoe. The hop is a most exhaustive crop, and unless land be liberally and regularly manured it will soon cease to give a remunerative return, though virgin soil, for a few years, may continue to produce good, and at times large yields.

"This failure," writes Mr. Whitehead, "will not seem astonishing, when it is realized what an enormous amount of the requisite ingredients of the soil is taken away in a crop of hops, leaves, and bine. The most judicious and lavish supply of those manures which chemical science has taught to be suitable cannot adequately replace the potash, the lime, the phosphoric acid, the silica, and the other essential elements annually absorbed. Mr. Nesbit says, in his elaborate report upon the analysis of the hop,† that it is well known to farmers that hops require more manure for their proper development than any other plant which they cultivate. In this same report Mr. Nesbit gives detailed statements of the quantities of each mineral ingredient taken from the land by a given crop of hops. Though he and Professors Way and Johnstone differ slightly, yet, if an average of the estimates of these three great authorities is taken, it leaves no doubt as to one great cause of the gradual failure of hop-grounds. The American hop-growers are quite aware of this, and as soon as a ground displays signs of having exhausted the soil it is grubbed up. They manure very little, just putting a spit or two of dung on the crown of the hill, rather for the purpose of protection from frost, while the average of the duration of their grounds is not more than nine years, even in the limestone districts."

* In France poles are steeped in sulphate of copper, or the solution is forced up by heat, as in the creosote process.

† *Journal of the Royal Agricultural Society of England*, vol. vii., p. 211.

Manures rich in nitrogen, such as Peruvian guano, woollen rags, shoddy, blood manure, refuse of boiling-down and meat-preserving factories, &c., are best suited for hops; but farmyard manure, superphosphate, and bone-dust are likewise much used. The refuse hops of breweries possess very high fertilising properties, and should be applied, when obtainable. In Tasmania, it is reported, as much as £12 per acre is in some instances paid away annually for manure.

Yield.—The yield of hops per acre varies from 10 cwt. in some years to over 1 ton in others, 12 cwt. being considered an average crop.

Cost of Picking.—Much difficulty is experienced in obtaining labor during the picking season, and this, to some extent, regulates the extension of hop-grounds. In Gippsland 3d. per bushel is paid, at which price good wages can be earned, especially when the crop is good, and the bine not over encumbered with foliage. In the Ararat district women and children are paid 2s. per day, and found, during the hop-picking season. One gentleman, writing from Gippsland, remarks that the operation of picking is effected by women, children, Chinese, and Aboriginals. The blacks, he says, come up from Lake Tyers at picking time, and they are the cleanest pickers we have. Aboriginal labor is employed at the Blacks' Station, Coranderrk, in all the unskilled operations of hop culture, but it has been found necessary to employ white labor to lead the Aborigines, as they will not work when left alone.

Diseases.—At present, none have been observed in Victorian hop-plantations; but it would be unreasonable to expect our hop-grounds to remain long free from disease under the exhaustive system of management at present in vogue. Diseases, to a considerable extent, are brought on through weakness of the plant, and inability on its part, by reason thereof, to throw off blights and such like affections; and this weakness is due to a deficiency of available food constituents in the soil, dependent on long-continued cropping without manure.

Though Victorian hop-grounds have enjoyed thus far an immunity from disease, those of the neighboring colony of Tasmania have been oftentimes seriously affected, the chief source of harm being the red-spider, a minute insect which infests the plant in countless numbers, and which, by reason of the peculiar appearance given by it to the leaves, has been called in England "*fire blast.*" The red-spider is a dreadful scourge in some seasons, more particularly in hot, dry summers. In the unusually hot, dry summer of 1868, this spider did immense damage in England and on the Continent. The leaves turned

brown, dried up, and came off the bine as if it were late autumn, and thousands of acres produced nothing.* In Tasmania, likewise, the injuries from this source at times have been very considerable. One instance has been reported of red-spider in a Victorian hop-ground; but it is perhaps not quite clear that the case in question was one of red-spider, as none of the other hop-grounds in the vicinity appear to have been affected. Washing or syringing with plain water will stop the progress of the red-spider; but sulphur fumes, or a solution of sulphur, will, it is said, destroy the insect. There are two other diseases or blights to which the hop-plant is very subject, viz., aphides, and mould or mildew. The former may be prevented by washing the plant with soft soap and water, or tobacco juice; and the application is tolerably efficacious if the operation be carefully performed. The washing may be repeated, if necessary, at intervals of ten days, but it must not be done while the plant is in bud, nor when the flower is beginning to ripen, lest the condition be injured. The hop-mould, or mildew, resembles very closely the oïdium, or vine mildew, and is equally destructive in its effect. Like the vine mildew, however, it may be cured by applications of sublimed sulphur. The sulphur should be administered by the aid of a sulphur-bellows, or sulphurator, and should be applied only in warm, dry weather. Though the hop has not been visited in Victoria by any of the diseases common to the plant, it has not been altogether free from the attacks of injurious insects. Instances have been reported where the common black caterpillar, which is so destructive to grain crops, has destroyed plants by gnawing through the bine a few inches above the ground. But the locust, which is generally so greedy after any green thing, will not, it appears, touch the hop-plant. A gentleman residing in the Ararat district writes — "When the locusts were here last season by clouds, they did not touch my hops, owing perhaps to the roughness of the leaves."

Drying.—The process of drying can only be properly accomplished in one way, viz., by means of a hop-kiln. Where large quantities of hops have to be dried, kiln accommodation becomes indispensable; for unless the drying be effected shortly after the hops have been picked, they heat, and lose both color and quality.

Through the kindness of Mr. A. W. Howitt, P.M., who has furnished me with drawings and particulars of his hop-kiln, erected at Bairnsdale, I am enabled to give the annexed woodcuts and description of a kiln

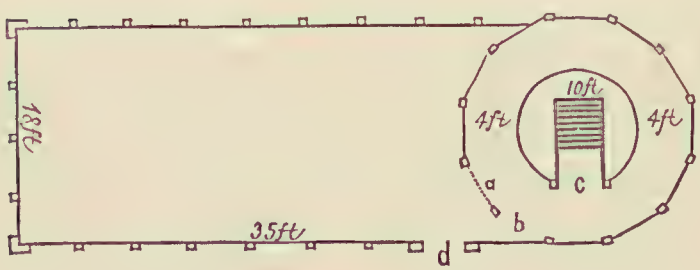
* Whitehead.—"*Recent Improvements in the Cultivation and Management of Hops;*" *Journal of the Royal Agricultural Society of England*, Second Series, vol. vi., part ii., page 355.

built in the colony from plans obtained in England, but subsequently adapted to colonial requirements and circumstances.

Fig. 2.

Hop-kiln at Eastwood—Elevation.

Fig. 3.

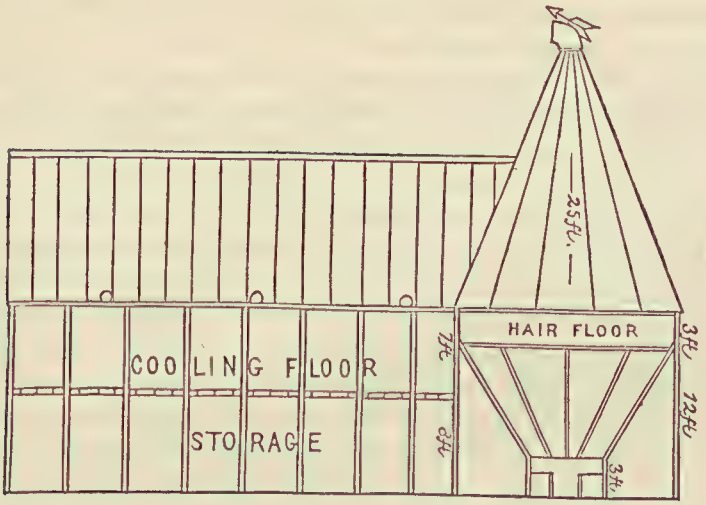


Ground Plan.

The kiln is 18 feet in diameter. The outer walls are of 8-inch squared box posts, 18 feet long, 3 feet in ground, and well charred, filled in with horizontal slabs, well fitted at the edges. 12 feet from the ground bearers are mortised in all round to support the joists of the floor; wall-plates are placed on the top of the posts and secured by shoulders. Roof framed of perfectly straight stringybark saplings, covered with battens of width to receive shingles; completed with iron cowl, 25 feet above wall-plates in vertical height.

Floor of kiln to receive hair-cloth formed of joists 6 x 2, overlaid by battens 1 inch apart; edges of battens carefully smoothed. From hair-floor to wall-plate lined inside with tongued and grooved lining boards. From wall-plates, for two-thirds of height of roof, plastered inside. Entrance to hair-floor by door at (*a*) opening into cooling-floor.

Fig. 4.



SECTION.

Furnace of 9-inch brick wall, 4 feet from wall of kiln; at 3 feet from ground provided with wall-plate, from which rise rafters to the hair-floor, lined inside with palings, and a single course of brickwork, and plastered inside. Entrance to furnace (*c*) by door sliding up or down in grooves, to regulate draught; inside of furnace floored with brick, and provided with fireplace, with strong furnace bars, to burn charcoal; above fireplace spark-plate of iron, suspended by fencing wire from hair-floor. Entrance to kiln by door (*b*) from stowage-room.

Cooling and Packing House.—35 feet by 18 feet; formed of 9-inch squared box posts, 18 feet long, 3 feet in ground, and well charred at butt. Eight posts at side and five at end; upper end of each post cut with shoulder to secure wall-plate; at 7 feet 6 inches from ground wall-plate mortised into posts to receive flooring joists. Floor of cooling-room of joists 6 x 2, 20 inches apart from centre to centre, and floored with tongued and grooved flooring. Lined inside for 2 feet 6 inches with tongued and grooved lining, and for 3 feet higher with hessian. Two windows on the ground floor, and also the upper floor, to open when required. Three strong tie-beams. Roof of straight stringybark saplings, peeled, and roofed with sound sheets of stringybark. Wall of building covered with sheets of stringybark nailed to posts and cross battens, and fastened down outside with battens. Roof secured with the usual jockeys and riders. Posts of building placed so that by inserting intermediate studs building can at any time be covered with weatherboards. Door into stowage-room at (*d*); entrance to cooling-room and kiln by steps, with handrail, &c., as shown in sketch.

The following general description of a hop-kiln by Mr. Rouse is quoted in the third volume of "*The Transactions of the United States Department of Agriculture*," and will serve for the purposes of this article:—

"The hop-oast, or kiln, should be of a size proportionate to the quantity of hops to be cured, so that they may not accumulate on hand. To avoid this, it will generally be necessary to keep the kiln heated both day and night. It is commonly built of an oblong form, and of two stories; the lower part being occupied by the kiln and the press-room, and the upper part by the drying-floor over the kiln, and by a room of about an equal size for storing the dried hops, which will of course be over the press-room. Kilns are sometimes built of bricks or stone, of a circular form,* with a round opening in the apex of the roof, surmounted by a movable cowl, or swinging ventilator, to enable the vapor of the drying hops to escape easily. If the building is of wood, the sides of the kiln should be lined

* The circular form is now generally preferred, as it occupies less room, while it affords more available space than any other shape.

with brickwork, or thoroughly lathed and plastered. It is found to be most convenient and economical to heat it with stoves, from two to four of which will be necessary, according to the size of the kiln. The drying-floor should be ten feet from the ground,* that there may be no danger of scorching the hops in drying. This floor is formed of slabs about one and a half inch in width, and the same distance from each other. These are covered with a strong coarse hair-cloth, of open texture, so as to admit of a free transmission of the heated air from the kiln below. The drying-room should be of a comfortable height, for a person to work in it, and the sides should be lathed and plastered, that there may be no irregularity of the heat in different portions of the room during high winds. A good ventilator should be provided in the roof, as described above. Openings should be left in the walls near the bottom of the kiln, to admit fresh air from without, the draft to be regulated by means of flues, or sliding-doors. The cloth for the drying-floor should be stretched over the slabs, and firmly nailed. On this floor the hops are spread to a depth of six or eight inches. The proper thickness will depend somewhat on the condition of the hops. If they are very full of moisture, they should be laid on quite thin; but if gathered when fully ripe, and in fine weather, a depth of ten inches will be allowed. The hops being spread as evenly as possible, the fires are immediately kindled in the kiln, and the temperature regulated to one uniform degree of heat. This, however, may be quite high at first, as there will be at that time but little danger of scorching the hops if the floor is sufficiently high. If the hops are rusty, or discolored from any other cause, it is usual to burn a little sulphur under them, which will bring them to a uniform appearance. This is done as soon as the hops are well warmed through, and feel somewhat moist. Great prejudice formerly existed against the use of sulphur in drying hops; but no objection is now made to it by the brewers, and it is generally thought that the use of it improves the appearance of all hops, and that it also facilitates the drying."

"During the drying process the fires should be kept up, and there should be a free supply of fresh air below, sufficient to keep up a regular succession of heated air from the kiln, passing through the hops, and out at the ventilator, carrying with it the vapor expelled from the drying hops. It will be found far preferable to a still, dead heat.† As soon as the upper part of the hops appears to have felt the fire, the lower part may be considered as nearly dry, and will rattle a little. The heap may then be turned. Before this is done, the heat should be suffered to abate a little, and increased again after the turning is finished. I am aware that many do not turn their hops while drying, nor suffer them to be disturbed at all until they are ready to be removed from the floor. Still, the better opinion, I think, is in favor of turning, as tending to facilitate the drying, and render it more perfect by the more effectually exposing every portion of the mass to the action of the heated current of air than would be the case were they allowed to remain as at first deposited on the floor, containing many inequalities in density even when the utmost care is exercised in their distribution. If turned at the right time, and in a careful manner, there need be no injury done to

* In more modern kilns, the drying, or hair-level, is at least 12 feet from the fire.

† "The great object," says Mr. Morton, "with the hop-drier is to get rid of the condensed vapor from the green hops as quickly as possible, and the drying-houses should be so constructed as to effect this object perfectly. It must be borne in mind that hops should be dried *by currents of heated air passing rapidly through them, and not by radiation of heat.*"

the hops.* When sufficiently dried, they should be allowed to cool off a little, if time can be afforded, otherwise there will be great danger that they will break in moving, or a portion of them shell off and waste. Ten or twelve hours are required to dry a kiln of hops. Two kilns may be dried in twenty-four hours by keeping the heat up through the night. A twenty-foot kiln will thus dry 400 bushels in a day, as they come from the vines, making about 750 pounds of hops when dry."

"It has been ascertained," writes Mr. Whitehead, "by scientific researches as to the weight, velocity, and desiccating power of heated atmospheric air, and confirmed by experience, that the height of a circular kiln above the hair should be one and a half times its diameter at the hair-level, and that the opening at the summit for the egress of air should be one-seventh of the same diameter. It is also calculated that, according to the present method of drying hops, apertures for the admission of atmospheric air should be judiciously arranged and carefully regulated in the lower part of the kiln under the hair, upon the following scale, viz.—6 feet of aperture (superficial) for a 16 feet kiln, 8 feet of aperture (superficial) for an 18 feet kiln, and so on, in order that the greatest possible amount of moderately heated air may pass quickly through the hops. Hops were formerly stewed dry, by concentrating stove-heat upon them. Now the great object is to desiccate them—to drive off their moisture—by a process as nearly resembling the action of the sun and wind as can be suited to the circumstances. It is understood that the temperature to which hops should be subjected ought not to exceed 130°; beyond that point, it is generally admitted that a serious loss of essential principles occurs."

Baling.—The following directions are given by Mr. Rouse :—

"The hops being dried, the next process is to bale them. This should not be done immediately after they are taken from the kiln, but they should be allowed to lie a few days in the store-room till they become a little softened, otherwise their extreme brittleness will cause them to be much broken in baling, and the sample thereby greatly injured. The bales should be of a symmetrical and convenient form, and should contain about 200 lbs. They are formed in a box or bin prepared for the purpose in the press-room, of such shape as will give the desired size and form. Across the bottom and sides of this box the baling cloth is first laid, and the hops are then let down into it from above and trodden down as they are dropped in until it is filled. Another cloth is then carried over the top, a follower applied, and the screws of the press turned down upon it until the whole is brought into a compact mass. The box is then taken apart, the cloth neatly secured around the bale, the screws are run up, the bale taken out and the ends cased, when it may be considered finished, and the same process is repeated in forming another."

Perhaps the greatest mistake which has been made in the planting of hop-grounds in this country has been the placing of them on too low ground—ground subject to the influence of floods. The falling into this error has been the cause of serious loss to some of the pioneers of hop-culture in Victoria. One grower writes :—"The great mistake we

* Good managers rarely have their hops turned more than once.

made was in putting the hops on the lowest parts of the flats, instead of the highest. Of the 20 acres which I planted, 6½ only survived the great floods of 1869 and 1870." A second writes in similar terms :— "One garden of 10 acres," he states, "was destroyed by repeated floods in 1870, and this was our best plantation." While a third reports that "a plantation of 10 acres, which he had completed, was soon afterwards washed away by the heaviest floods ever known in the creek, completely destroying the whole, and causing him a loss of £300." In other countries, gentle slopes to the east and south-east are generally selected for hop-plantations, an example which might be followed with advantage in this colony in districts where moisture is ample, without need for recourse to low-lying land. At all events, the aim of intending hop-growers should be to place their plantations beyond the reach of floods.

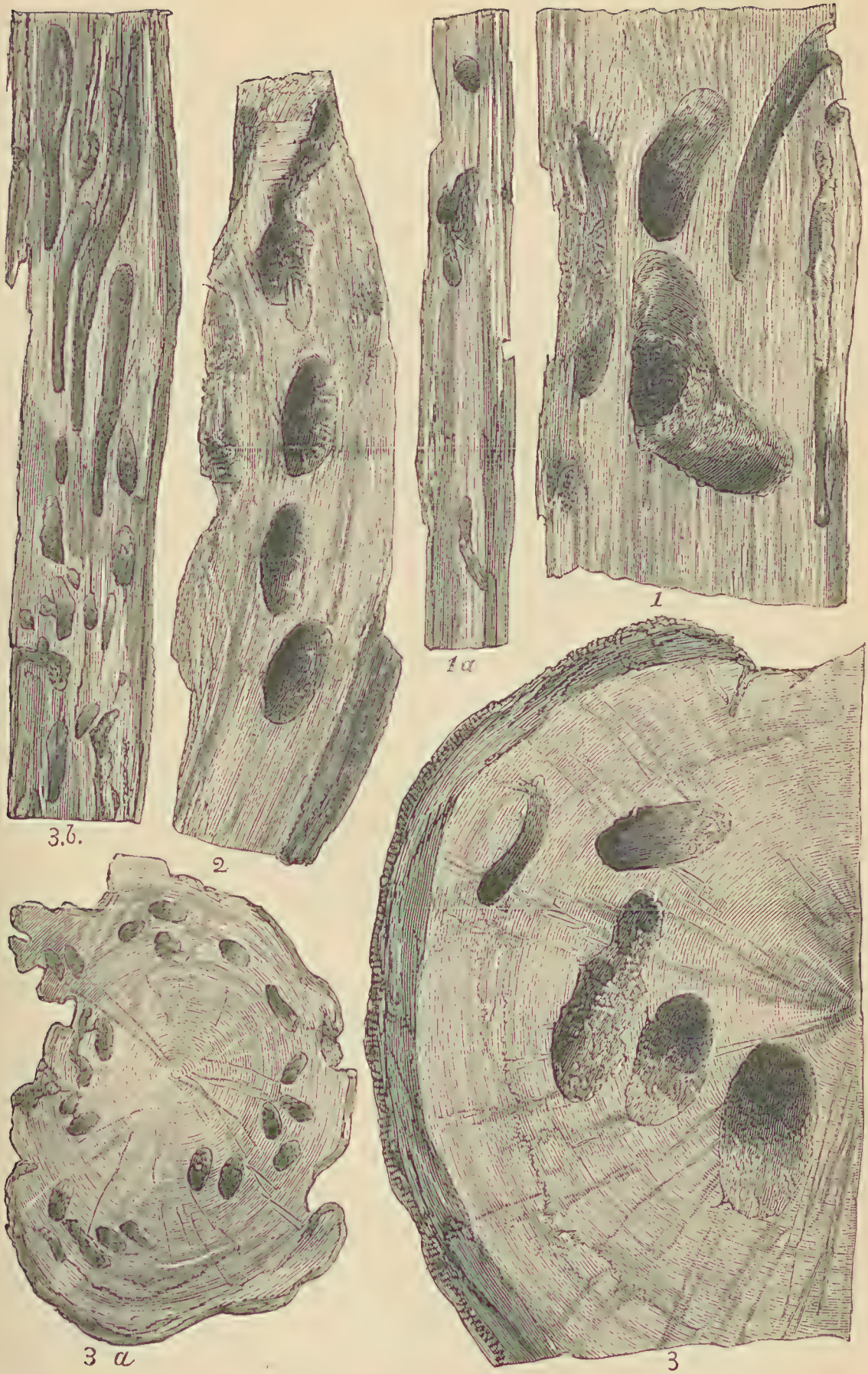
ENTOMOLOGY.

DESCRIPTION OF SOME AUSTRALIAN WOOD-BORING CAPRICORN BEETLES.

By Mr. Charles French.

Prefatory Note by the Secretary for Agriculture.

The study of entomology is one of far greater importance to persons engaged in the cultivation of the soil than at first sight appears. The casual observer considers the subject one of small significance—one unworthy the attention of any sane individual; while the uneducated pass it by unnoticed, and deem a person a fool who devotes any portion of his time to its study. The farmer, the grazier, the forester, and the gardener too, with a few honorable exceptions, are apt all to look upon entomology as a matter of only secondary importance; and, except when wheat is destroyed by the weevil, a field of turnips by the fly, pastures are laid bare by the ravages of locusts, orchards and gardens by aphides and other insects, and the timber of a young forest



SECTIONS OF TIMBER PERFORATED BY WOOD-BORING BEETLES.

1. *Acacia mollissima, natural size.*
1*a*. „ „ *reduced.*
2. *Eucalyptus viminalis, natural size.*
3. *Eucalyptus globulus, natural size.*
3*a*. „ „ *reduced.*
3*b*. „ „ *longitudinal section.*

is rendered valueless, except for firewood, by the devastation of wood-boring beetles, they pay little or no attention to the subject. But when such or similar misfortunes overcome them, they expect not unfrequently that some person will come forward with a preventive, if not a cure, forgetting altogether that such can only be discovered after years of careful observation and much experimental research. Governments, likewise, view this subject disparagingly, and until late years—and then in only a few instances—have done but little towards the investigation of this vast and interesting, not to say useful field of research, for the purpose of giving results to the world. It is with the object of seeing a commencement made in this direction in Victoria that I have induced Mr. French to furnish me with descriptions of some of our most destructive wood-boring beetles for publication in this report; and I have to express a hope that it may suffice to show the importance of the subject, and prove only the beginning of a systematic inquiry into a subject which causes this and every other country, year by year, incalculable loss.

A. R. W.

Wood-boring Australian Capricorn Beetles.

Fig. 5.

PHORACANTHA TRICUSPIS.

Phoracantha tricuspis (*Newman*).—This insect, which belongs to the well-known family of the longicorns, or perhaps better known as capricorn beetles, is one of the largest of the Victorian species with which we are acquainted, being second in size only to mallodon edule, the larvæ of which destroy the Banksia or native honeysuckle

on the sea-coast. The phoracantha generally makes its appearance about February and March, and is seldom to be seen during the day, the dusk of evening being the most favorable time for observing its movements. These insects are generally found in pairs, male and female. The timber selected by them for destruction is the eucalyptus viminalis, the so-called bastard peppermint of colonists. On these trees their ravages are quite astonishing, and for miles around Melbourne, where the above-named eucalyptus is plentiful, it is a noticeable fact that few, if any, are exempt from their destructive propensities; and, like many of the members of the great family to which they belong, they are armed with formidable mandibles, which enable them to gnaw with surprising rapidity. A section of eucalyptus viminalis, which has been bored by this insect, is shown at Fig. 2 in plate of woods. The larvæ, which are little known at present, no doubt contribute greatly to the work of destruction. This family, it may be of interest to remark, furnishes us with the largest known coleopterous insects, viz., prionus giganteus and macrodontia cervicornis, both from the French settlement of Cayenne. These are upwards of six inches in length, exclusive of the antennæ, which are alone a few inches long.

Fig. 6.

EPITHORA DORSALIS.

Epithora dorsalis (*Macleay*). — This very destructive insect, also of the longicorn family, is very common near Melbourne, and is to be found both in the larvæ and in the perfect state in the young saplings of eucalyptus viminalis. A noticeable fact here occurs, viz., whereas phoracantha tricuspis is found only in timber of mature growth, the epithora is never taken but in the young plants of from say ten to twenty feet high; its ravages are therefore more serious than at first would appear, taking into consideration the fact that the saplings are so extensively used for mining purposes, building, &c., throughout the colony. The epithora is to be taken about the dusk of evening throughout the earlier portion of summer in large groups of from ten to fifty specimens, male and female, and when taken in the hand make a chirping sound. This is one of our very worst enemies of this order, being so numerous and its ravages so considerable, that a sapling, to outward appearance quite sound, upon examination is found to be a mere mass of rotten wood, having very much the appearance of a plant that had perished through dry-rot; and, by way of example, it may be

mentioned that out of sixteen pieces cut for firewood not one was found but what had been attacked, not only whilst living, but even after it had been for months heaped up in a wood-yard.

Fig. 7.

RHAGIOMORPHA TEPURIOIDES.

Rhagiomorpha tepurioides (*Boisduval*).—This longicorn, which may be fairly classed amongst the less destructive of our coleopterous insects, is found in the vicinity of Melbourne, and, unlike its fellow-destroyers, is to be taken during the day. No doubt many colonists may have noticed that it makes its appearance in considerable numbers late in the summer, especially when a tree has been felled. This circumstance may be accounted for thus:—The insect lives wholly in and upon the branches of the various species of eucalyptus, principally in the bastard peppermint, eucalyptus viminalis, and eucalyptus meliodora—the yellow box-tree of colonists; and it is seldom seen, excepting when a branch is either cut, broken, or blown off by the wind; and for the disfigurement of a greater portion of the upper parts of our gum trees the rhagiomorpha is responsible. I have never noticed this beetle boring into the trunk of a tree. This insect bears a great resemblance to some of the European species of capricorn beetles.

Fig. 8.

CALLIRHOE ALLAPSA.

Callirhoe allapsa (*Newman*).—The callirhoe allapsa is one of those insects that may safely be placed in the same category, as regards its destructive propensities, as the rhagiomorpha; but it is fortunately not sufficiently numerous to do a very large amount of damage. Nevertheless, this insect is somewhat remarkable, inasmuch as it invariably attacks the most solid trunks of the eucalyptus meliodora to such an extent as would, in the course of time, prove very serious to the supply of this timber if permitted to remain unchecked. The callirhoe, in common with the greater portion of this family, is seldom taken in the day time, the evening, after a very hot day, being the best time to watch its movements.

Fig. 9.

CERAMBYX SERICUS.

Cerambyx sericus (*Newman*). — This very destructive insect belongs to a large and well-known genus of this family, which genus is widely distributed throughout the known world; almost every country furnishes some specimens of the cerambyx. This insect is remarkable for the loud chirping sound which it makes upon being taken in the hand. The destruction of the greater part of our common wattle-trees, acacia molissima, is caused by this insect, which bores persistently into the soundest part of the tree, both in the sapling and in the matured growth, thereby making great havoc, and speedily transforming into a sort of architectural gallery the timber that would otherwise have grown to maturity, and furnished a considerable amount of bark for tanners. Sections of acacia mollissima, illustrating the devastion of this insect, are shown at Figs. 1 and 1*a* in plate of woods. The acacia above mentioned seems to be specially favored by these destructive visitors. First, the wood is perforated by the cerambyx and other longicorns, then the larvæ of several lepidopterous insects contribute their services; this being done, the bostrychus jesuitus, and several species of deretaphrus, finish the unfortunate wattle, and, should life not be quite extinct, the symphyletes, of which we shall speak further on, and a plant or two of our native mistletoe (loranthus), complete the work of spoliation. The cerambyx is found in the dusk of the evening crawling up the trees in considerable numbers, and the exudation, which no doubt many may have noticed, is caused, not by the cerambyx alone, but by a combination of the above-named pests, the foremost of which is cerambyx sericus.

Fig. 10.

PHORACANTHA RECURVA.

Phoracantha recurva (*Boisduval*). —This species is found on and in the wood of the common wattle, and, like the cerambyx, is very destructive, and at the same time sluggish in its movements, generally taking up its abode in abandoned holes of the cerambyx and other wood-boring insects; fortunately, however, it is not plentiful, but is sufficiently furnished with strong mandibles to do considerable

damage, which it undoubtedly does. This phoracantha is frequently found singly or in pairs in the day time; it also has the singular propensity to feign death when taken in the hand; also of dropping off the tree when any intruders are within sight or hearing, which procedure is very often observable when collecting insects, more especially amongst the buprestidæ and elateridæ, the latter perhaps better known as skip-jacks or click-beetles.

Fig. 11.

CALLIRHOE ABERRANS.

Callirhoe aberrans (*Newman*).—The genus callirhoe, which is closely allied to phoracantha, furnishes us with some of the most elegant forms of the longicorn family, as well as some of the most destructive of the large order of coleoptera. This insect is found chiefly in the wood of the common wattle, in the vicinity of Melbourne, and in some seasons is rather abundant, especially after a lengthened drought and preceding rain. It is, however, not very common as a rule, yet it is of sufficient interest to rank with our destructive insects, as it is essentially a wood-feeder, and may therefore be classed amongst our enemies. It may not be uninteresting to remark that the genus phoracantha and callirhoe are exclusively Australian, at least as far as has yet been determined.

Fig. 12.

SYMPHYLETES NODOSUS.

Symphyletes nodosus (*Newman*). — This pretty insect is chiefly remarkable for the curious manner in which it commences operations in destroying the common wattle tree. Whereas most of the wood-borers (that is to say, those of which we are at present treating, excluding the lucanidæ, &c., which carry on their operations underground) attack a tree at the butt, the symphylete commences its work of destruction at the top of the tree, thereby working conjointly with the cerambyx, phoracantha, &c.; it is, however, not very numerous, and perhaps hardly deserves the bad reputation attached to it. Specimens of this beetle are found generally singly on old fences, but sometimes a number may be taken together on the branches of the above-mentioned acacia.

Fig. 13.

PHACODES OBSCURUS.

Phacodes obscurus (*Fabricius*). — This insect is by no means common, yet there are ample proofs of its depredations, both near Melbourne and in other parts of the colony. The phacodes is generally to be found under the bark of the common wattle (on which tree it lives), sometimes in pairs and at other times singly, and, like some of the other species, it is rather sluggish in its movements. February and March are the two most favorable months for making observations on this insect; and it is to be taken both during the day and at night time, and but seldom on the wing.

Fig. 14.

PHORACANTHA SEMI-PUNCTATA.

Phoracantha semi-punctata (*Fabricius*).—This is an isolated species fortunately, and is confined chiefly to the districts of Brighton and Caulfield and surrounding country, feeding upon the wood of small plants of a few years' growth of eucalyptus viminalis. This insect is becoming rarer every season, so that we may reasonably look forward to its non-existence at no distant date, at least near Melbourne. This phoracantha is often found whilst searching for one of the chafers (xylonynchus eucalypti) which destroy the foliage of our young gums in a similar manner as the anoplognathus, our Australian representative of the European melalontha vulgaris, which may be treated on in a subsequent paper. Before closing these remarks it may be well to state that we are indebted for the slow though sure diminution of these destructive pests to the insectivorous birds, more especially to those indigenous to Australia; secondly, to the enormous rapacity of our spiders. For what observer has failed to notice, upon pulling off the loose bark from the gum and other trees, the heaps of *débris*, mainly consisting of the bodies of innumerable insects which have been killed by spiders, generally to the chagrin of the entomologist?

The sections of bluegum, eucalyptus globulus, shown at Figs. 3, 3*a*, and 3*b*, in plate of woods, were cut from a tree of from 10 to 12 years old, growing in the Albert Park, near Melbourne, and present but a fair average specimen of the destructive powers of the various kinds of

wood-boring insects when left unchecked, as in the present case. The bluegum is one of the most susceptible of our native trees to the attacks of insects, chiefly on account of its tendency to fruit prematurely, which causes decay and renders it an easy victim to the depredations of destructive insects; it is for this and other reasons that the bluegum should not be chosen in Victoria for a forest tree. Many persons who care to make observations of a useful nature, will no doubt have noticed at the foot of the bluegum, and indeed of many other of our native eucalypti, small heaps of matter resembling sawdust; these are made principally by the larvæ of a large moth, cossus lituratus, commonly known as the goat moth, which is constantly boring in every direction, the larva itself being a large, fat, white grub, said to be a great delicacy of the Aborigines, who roast it on their small ember fires. The perfect insect is a large greyish moth, with silvery bands across the wings; it measures about four inches from tip to tip of wings, is very sluggish, and is frequently to be taken in pairs, male and female, clinging to old stakes, palings, &c., during rough weather. It might, I think, be fairly classed among diurnal lepidopterous insects, the male being, as in most cases in this order, much smaller than the female, but generally much more brilliantly marked. Although this most destructive species is one of the very worst enemies of the bluegum, it is by no means the only one with which our native eucalypti have to contend, there being many others, chiefly belonging to the order Coleoptera. Among the other enemies of the bluegum are several species of the elateridæ; and one very fine though destructive insect named chrosis illita, an insect about one inch in length, and of a shining chestnut color; the larvæ is yellowish-brown, and of the form of the well known wire worm, A. sputator, of British celebrity. The bostrichidæ, passalini, and other insects in which the large family of the longicorns take an important part, all make common cause against the timber which is planted for the purposes of civilized man. There is one word of advice that I would offer to those who cultivate our eucalypti: be sure never to allow loose bark, which the tree casts off naturally, to remain hanging loosely about the stem of the tree, for it is in such places that these pests congregate, and hold, for all we know, a council of war, and lay schemes for the destruction of their next victim, when hidden from the observation of their enemies, the insectivorous birds, and rapacious insects, as spiders, hymenoptera, &c., and likewise from the view of the entomologist, who always knows where to search for his friends.

In conclusion, it may not be uninteresting to note a few of our principal wood-destroying insects:—

Trogositodæ.
Leperina squamata.

Colydidæ.
Deretaphrus fossus.
Bothrideres equirus.
servus.

Cucujidæ.
Platisis obscurus.
Brontes militaris.

Lucanidæ.
Lamprima rulitans.
Lissotus Howittianus.
Figulus lilliputanus.
Aulacocyclus edentulus.
furcicornis.

Scarabæidæ.
Cryptodus anthracinus.

Buprestidæ.
Cyria imperialis.
Nascio Parryi.
Melobasis nervosa.

Buprestidæ.
Curis caloptera.
aurifera.
Stigmodera variabilis.
macularia.
erythremalos.
Agrilus Australaisæ.

Elateridæ.
Chrosis illita.
Agrypnus, several sp.
Crepidonemus perforatus.
Alaus, several sp.

Longicornes.
Phoracantha tricuspis.
punctata.
quinaria.
robusta.
Phacodes obscurus.
personatus.
Rhagiomorpha lepturoides.
Tessaromma undatum.
Stenoderus suturalis.
Hesthesis plorator.
cingulatus.

and many others; my collection alone contains upwards of 1000 species that may be placed in this category.

Our native carabidæ should be specially protected, as they are no mean check upon the larvæ, and even upon the perfect insects which infest timber; the small lebia, the active silphomorpha, the adelotopus, and others too, may be seen scampering about under the loose bark in search of their prey—the smaller species of ips, brontes, &c.—which fall easy victims.

I trust that these remarks may serve to direct more attention to the depredation caused to our timber trees by insects, and that their ravages may be checked to some extent by the preservation of their natural enemies, the insectivorous birds, and also perhaps by other precautions which may be taken when the real depredators are properly known.

Botanical Garden, Melbourne.

THE APPLE AND ITS VARIETIES.

By Mr. John C. Cole.

It is not intended, in this paper, to go fully into the history and cultivation of the apple (this information can now be obtained from so many standard works on fruit trees that it appears here unnecessary), but to publish woodcuts of some of our more popular and useful varieties, and to accompany each with a full description embodying the writer's observation and experience in the cultivation of the variety in Victoria. The woodcuts are after drawings made by the writer from fruits grown in the colony, and the descriptions being the result of his personal observation, it will be manifest that this paper embraces strictly Victorian experience.

The apple has been chosen as being of all orchard fruits the most useful, and because it ranks foremost of all cultivated fruits. During every month of the year it is in use.

No sooner is the French Crab done than some of the early kinds of cooking apple are fit for use, and the early dessert apples soon follow. Dessert and cooking are not the only uses to which apples can be applied with advantage. The time is, probably, not far distant when cider will be made in large quantities in the cooler districts of the colony; and when apples become much more abundant than they now are, they will, doubtless, be dried and utilized as is done in America.

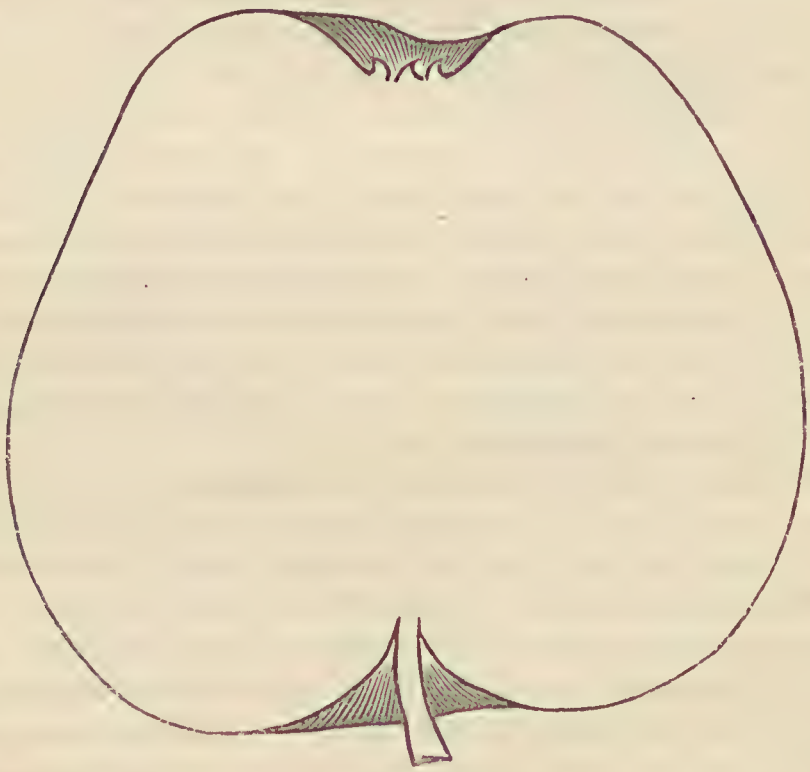
A great impetus has been given to apple culture during the last few years. The seasons have been favorable to the successful growth of the fruit, and the bringing into notice of several blight-proof kinds has done much to give zest and encouragement to those who were beginning to despair of profitable apple cultivation.

It will be observed that very few synonymes are given to the kinds described in this paper. The writer considers it inadvisable, as a rule, to publish more than one name for the same fruit. For example, the Reinette du Canada has about ten synonymes; but why publish and perpetuate them? The Reinette du Canada is known in the colony by that name, and it should be the aim of colonial pomologists to keep to the one name by which the variety is now known. Where a second name is frequently used, and the variety is sometimes called by the second name, a synonyme has been given—for example:—London Pippin, synonyme, Five-crowned Pippin.

ADAM'S PEARMAIN.—*Fig.* 15.

Fruit.—Medium to large, but seldom large. *Shape.*—High pearmain, evenly and handsomely formed. *Color.*—Greenish-yellow, strewed with large grey dots, and much covered with streaks of crimson, and with tracings and patches of russet. *Stalk.*—From half to an inch long, slender, and inserted in rather a deep funnel-shaped cavity, and frequently obliquely by the side of a swollen lip, like that of the Kerry pippin. *Eye.*—Open, with erect segments placed in a wide, deep, evenly-shaped basin. *Flesh.*—Yellowish, crisp, juicy, and brisk, with a fine rich flavor. *Foliage.*—Rather sparse and narrow, coming late into leaf in the spring. *Wood.*—Slender, dull brown, and spotted. *Habit.*—Spreading. *Season.*—From March, and continues in use several months. The fruit keeps well, and is a handsome and excellent dessert apple. The tree is a good bearer, and worthy of extensive cultivation. This is the variety which, for many years past, has been sent from Tasmania, and sold in the Melbourne shops under the name of Dutch Megnonne, a totally different variety.

Fig. 15.

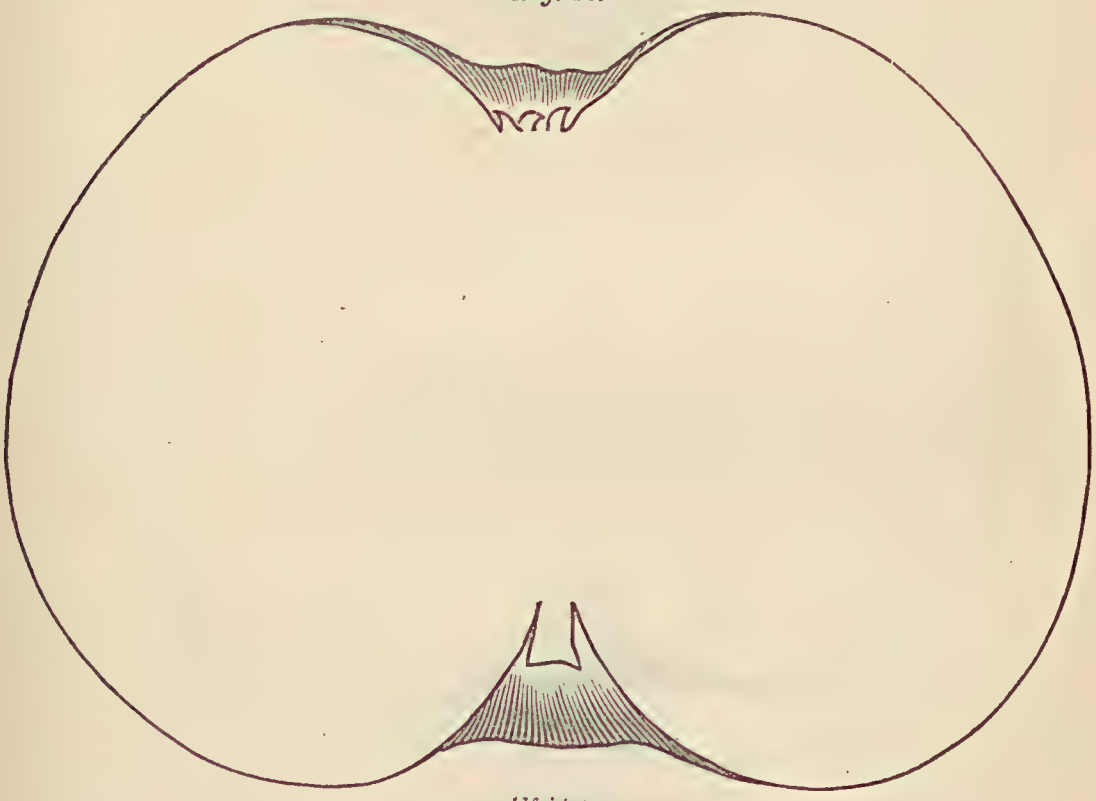


Adam's Pearmain.

ALFRISTON.—*Fig.* 16.

Fruit.—Large. *Shape.*—Roundish, irregularly ribbed; resembles in shape the Reinette du Canada, but tapers more towards the eye. *Color.*—Skin greenish-yellow, with faint broken red stripes over a portion of its surface, and with a high-colored cheek next the sun. *Stalk.*—Short, very deeply inserted in a russety cavity. *Eye.*—Open, placed in a deep basin. *Flesh.*—Yellowish-white, crisp, juicy, rich, and briskly sub-acid. *Foliage.*—Large, and resembles closely that of Reinette du Canada. *Wood.*—Dark-brown. *Habit.*—Spreading and robust; a good bearer, and first-class as a cooking apple. *Season.*—From April, and continuing through the winter.

Fig. 16.



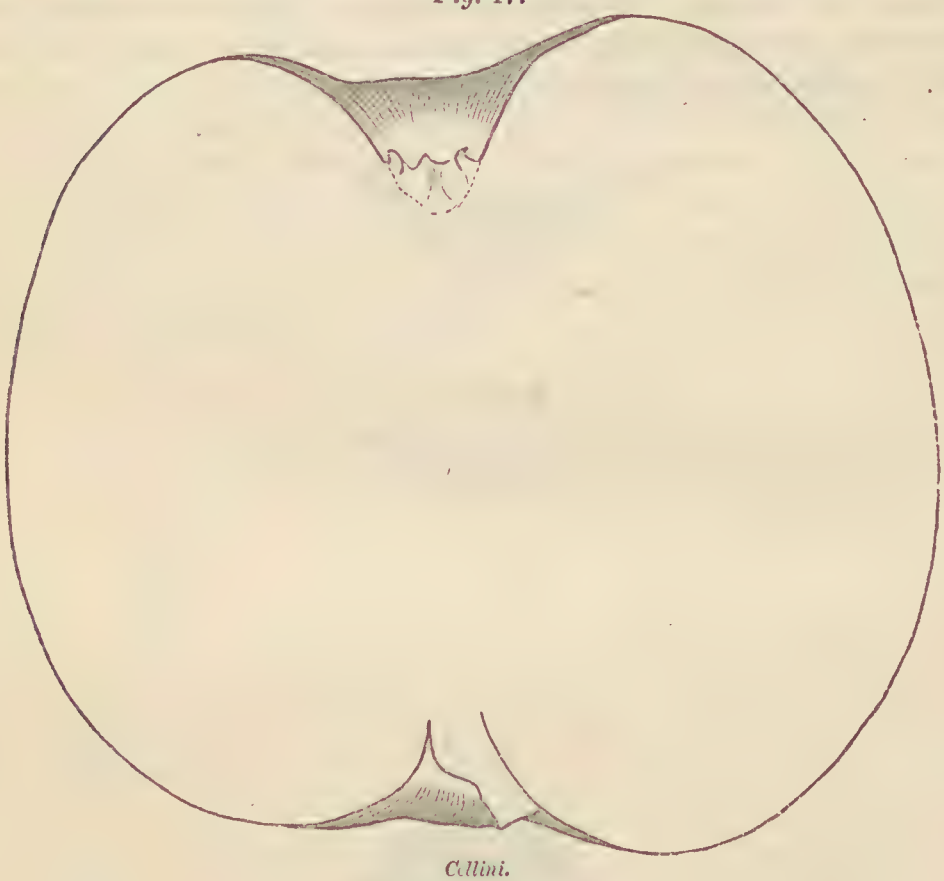
Alfriston.

CELLINI.—*Fig.* 17.

Fruit.—Above medium size, or large. *Shape.*—Roundish, flattened at both ends, slightly oblong, and handsomely formed. *Color.*—Skin deep yellow, washed, and beautifully striped with crimson; where much exposed the crimson markings extend over the whole surface of the fruit. *Stalk.*—Usually short, inserted in an even funnel-shaped cavity. *Eye.*—Large and open, and placed in a shallow-plaited basin. *Flesh.*—White, very tender, brisk, and juicy, with a delicate aromatic flavor.

Foliage.—Pale green; late in coming into leaf in the spring. *Wood.*—Reddish-brown. *Habit.*—Shoots upright. *Tree.*—Half-spreading and handsomely shaped. *Season.*—End of February and March in the Melbourne district; an excellent and highly esteemed cooking apple. Its soft flesh renders it specially adapted for making jelly. The tree is an abundant and early bearer, often fruiting when not more than two or three years old. It is said to have been raised at Vauxhall, England, and is not so subject to blight as many varieties. Plate larger than the ordinary size.

Fig. 17.



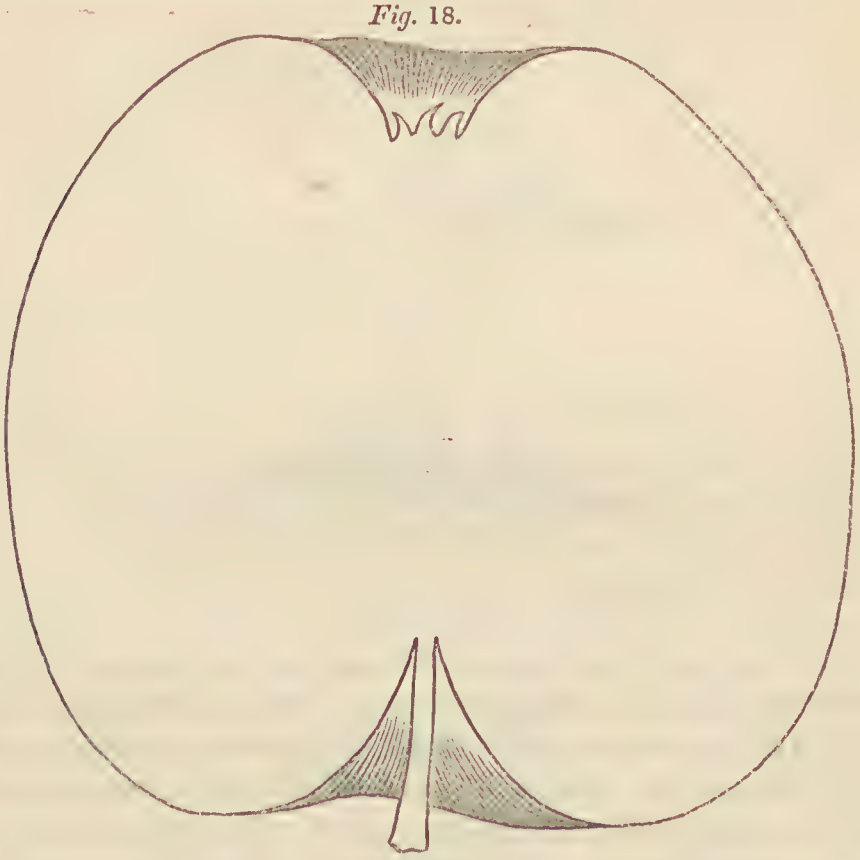
Collini.

CLEOPATRA.—*Fig.* 18.

Fruit.—Above medium size, or large. *Shape.*—Conical, somewhat angular and one-sided, yet handsomely shaped. *Color.*—Grass-green when gathered, changing as it becomes quite ripe to a uniform clear yellow, sometimes with a faint tinge on exposed side, and strewed with pearly specks. *Stalk.*—About three-quarters of an inch long, slender, inserted in a deep funnel-shaped cavity. *Eye.*—Nearly closed, placed in a deep irregular basin. *Flesh.*—Yellowish, tender, juicy, and richly flavored. *Foliage.*—Leaves not large, and very abundant, of a grass-green color. *Wood.*—Brownish-yellow. *Habit.*—Shoots upright.

Tree.—Half spreading, and of handsome growth. *Season.*—From April, continuing all through the winter. A very valuable apple, of fine quality, either for dessert or cooking. The tree is a heavy and regular bearer, and worthy of extensive cultivation. A few years back the variety was known by many under the name of New York Pippin. It is certainly not the New York Pippin of Downing, or of Scott, but appears to tally with the description of New York Pippin as given by Lindley in his "*Guide to the Orchard.*" Cleopatra appears now to be the generally accepted name, and this variety is known by most growers as such throughout the colony. The plate is from a well-grown sample, considerably above the average.

Fig. 18.



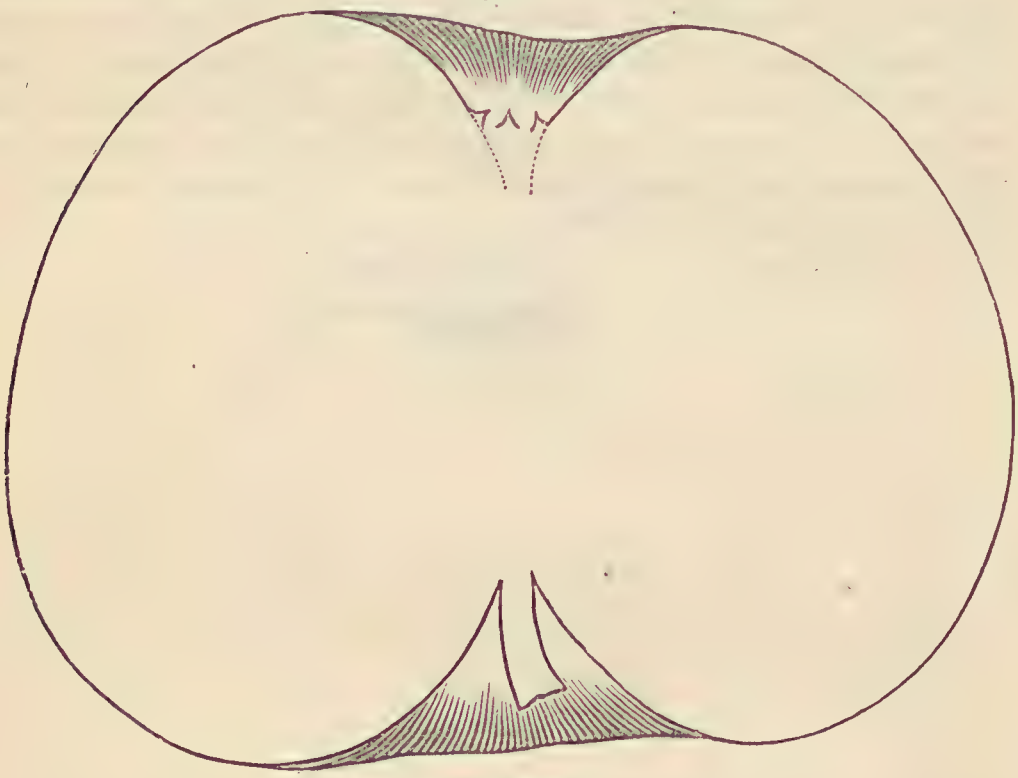
Cleopatra.

Cox's Pomona.—*Fig.* 19.

Fruit.—Above medium or large. *Shape.*—Short ovate, somewhat angular and flat, and broad at the base. *Color.*—Skin yellow, very much mottled, and striped with bright crimson, and strewed with light-colored specks. *Stalk.*—Varying from a quarter to one inch long, inserted in a deep funnel-shaped cavity. *Eye.*—Not large, partially open, placed in a deep furrowed basin. *Flesh.*—White, very tender, of

a delicate sub-acid flavor. *Foliage.*—Dull green; late in coming into leaf in the spring. *Wood.*—Dark-brown; tree spreading. *Season.*—End of February and beginning of March in the Melbourne district. A very beautiful early cooking apple, and a capital bearer.

Fig. 19.

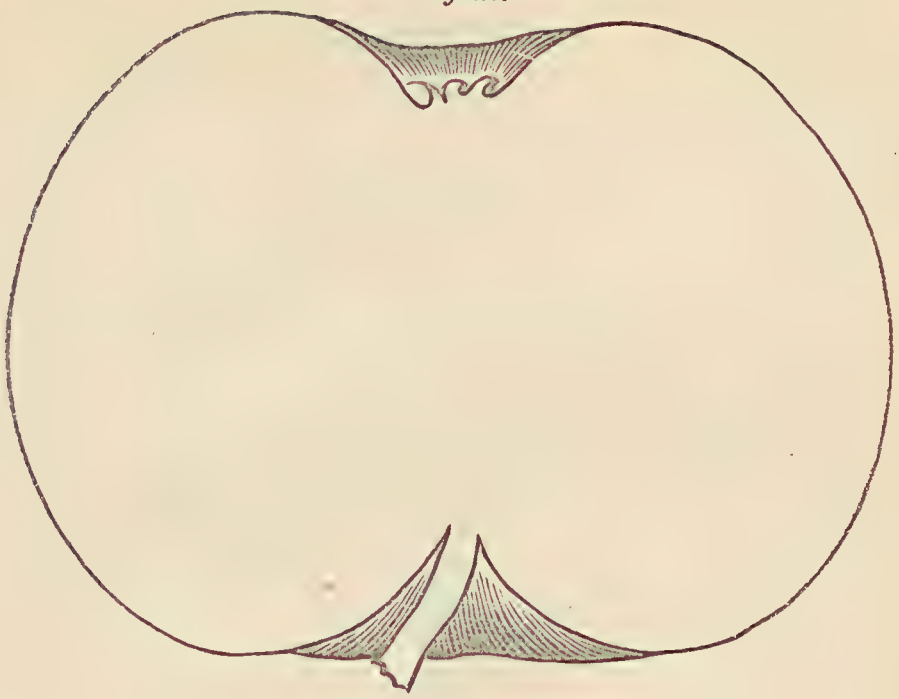


Cox's Pomona.

DUCHESSE D'OLDENBERG.—*Fig.* 20.

Fruit.—Medium, sometimes above medium, or large. *Shape.*—Roundish and flattened; regularly formed. *Color.*—Skin bright yellow, washed, regularly marked with bright red streaks, and covered with a delicate blue bloom. *Stalk.*—From half to three-quarters, sometimes one inch in length, inserted in a deep cavity. *Eye.*—Large and closed, placed in a round, shallow, puckered basin. *Flesh.*—Yellowish, brisk, juicy, and refreshing. *Foliage.*—Large, on long leaf stalks, coming early into leaf in the spring, and dying off early in the autumn. *Wood.*—Dark reddish-brown. *Habit.*—Shoots upright, stout, and vigorous. *Tree.*—Half-spreading, of compact growth. *Season.*—From beginning to end of January near Melbourne. A very beautiful apple; not first-class, either as a cooking or dessert fruit; but from its appearance and its almost unblighting qualities is sure to become a favorite. The tree is nearly blight-proof. The plate is from a fine-grown specimen.

Fig. 20.

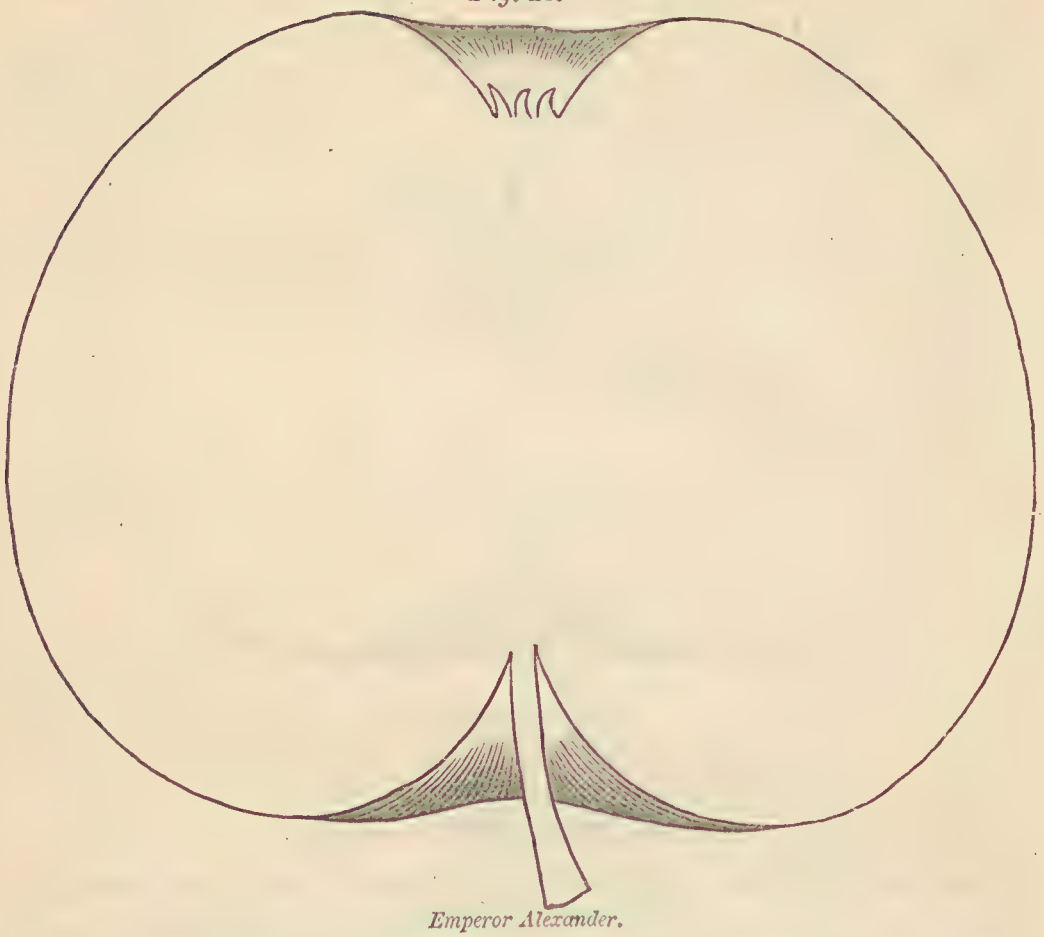


Duchesse d'Oldenberg.

EMPEROR ALEXANDER.—*Fig.* 21.

Fruit.—Very large. *Shape.*—Usually heart-shaped, or obtuse heart-shaped, but often much flatter. *Color.*—Greenish-yellow, striped and mottled with bright red (next the sun the red color often extends over the whole surface of the fruit), and covered with a beautiful bluish purple bloom. *Stalk.*—From one half to an inch long, slender, and inserted in a rather deep funnel-shaped cavity. *Eye.*—Rather large, closed, or nearly so, and placed in a deep but not wide basin. *Flesh.*—Yellowish-white, soft, rich, juicy, and aromatic. *Foliage.*—Large, pale green. *Wood.*—Reddish-brown, and spotted. *Habit.*—Of spreading open growth. One of the most, if not the most, beautiful apple in cultivation. The tree is a good and regular cropper, though it cannot be called a heavy bearer. The variety is of Russian origin, is a good cooking apple, and less subject to blight than many other kinds. A newly imported apple called Grand Duke Constantine, from Russia, said to be new, so much resembles the Emperor Alexander that I am inclined to believe the two to be identical, although some English pomologists consider them distinct. Plate ordinary size.

Fig. 21.

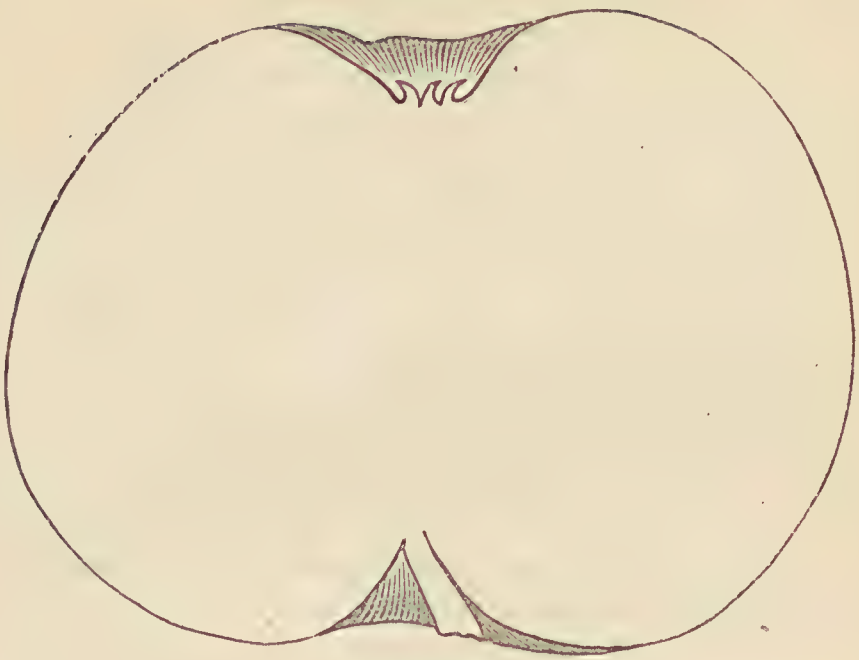


Emperor Alexander.

GRAVENSTEIN.—*Fig.* 22.

Fruit.—Above medium size. *Shape.*—Roundish and flattened, angular and broad at the base. *Color.*—Skin smooth, clear yellow, washed, and striped with streaks of light and dark crimson. *Stalk.*—Short, thick, inserted in a broad, moderately deep cavity. *Eye.*—Rather large, partially open, deeply placed in a plaited basin. *Flesh.*—Yellowish, crisp, tender, and rich, with an abundance of refreshing juice. *Foliage.*—Large, roundish oval, and flat, of a deep green color. *Wood.*—Dull brown. *Habit.*—Spreading, compact, and handsome, forming a beautiful round head. *Season.*—Ripe during February and part of March. An apple of the very highest excellence as a dessert fruit ; also cooks well. It is a good bearer, producing its fruit regularly throughout the tree. A tree which appears at first sight to have only a thin crop upon it, when the middle is examined fruit will be found throughout the centre of the tree, hidden from the sun by the dense dark foliage. Fortunately the tree is but little subject to the attacks of blight, and is certain to become an universal favorite. The plate represents a well-grown specimen.

Fig. 22.

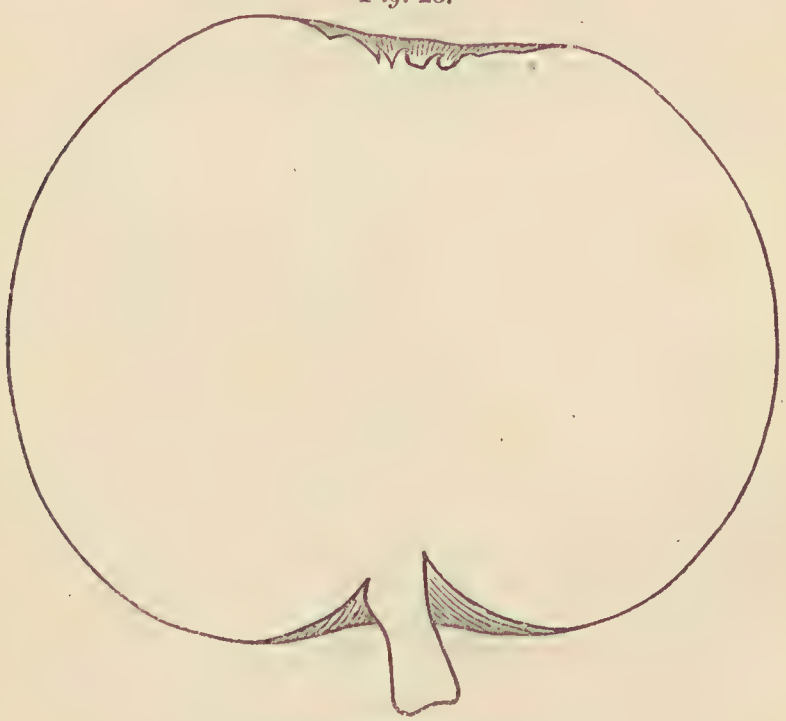


Gravenstein.

IRISH PEACH (SYN., EARLY CROFTON).—*Fig.* 23.

Fruit.—Medium size, sometimes above medium. *Shape.*—Roundish flattened, and slightly angular. *Color.*—Washed, mottled, and striped with red over a great portion of its surface when much exposed, with

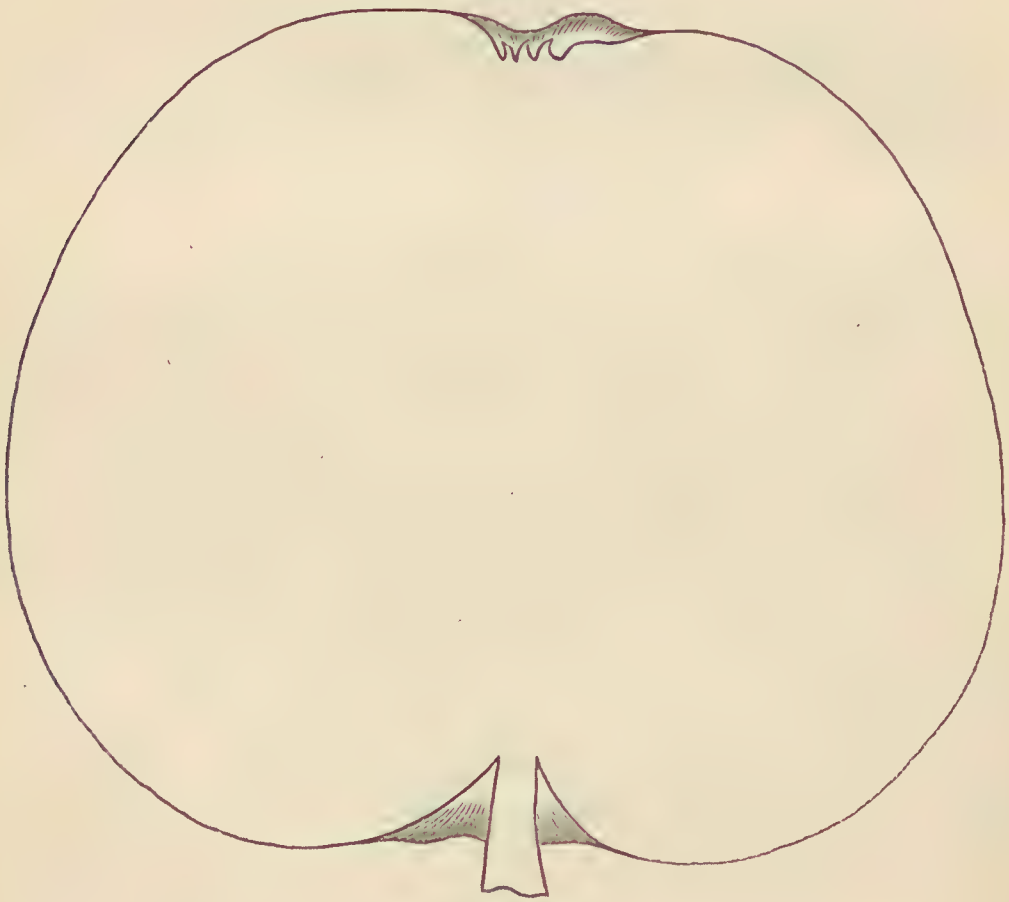
Fig. 23.



Irish Peach (Syn. Early Crofton).

thin russet round the stalk and base of the fruit, and thinly strewed with greenish-grey dots, and carrying a delicate bloom. *Stalk.*—From half to one inch long, stout and fleshy, inserted in a moderately deep cavity. *Eye.*—Large, nearly closed, placed in a broad shallow-plaited basin. *Flesh.*—Whitish, tender, very juicy, and pleasantly flavored ; requires to be gathered and eaten from the tree to get it in perfection. *Foliage.*—Medium size, rather spare on the tree, very downy. *Wood.*—Dull brown, and much spotted. *Habit.*—Spreading. *Season.*—During January. An excellent and beautiful early apple, fast becoming a great favorite, and from the fact of its being one of the three established blight-proof kinds is sure to be extensively planted. This, the Winter Majetin, and the Northern Spy are now proved beyond doubt thoroughly blight-proof. The Irish Peach is a good bearer ; but as the two-year old wood has a tendency to lose its spurs, rather severe pruning is necessary to keep the tree in a bearing condition. Care must also be taken not to trim off the lateral branches, as much of the fine fruit is borne there.

Fig. 24.



Lord Suffield.

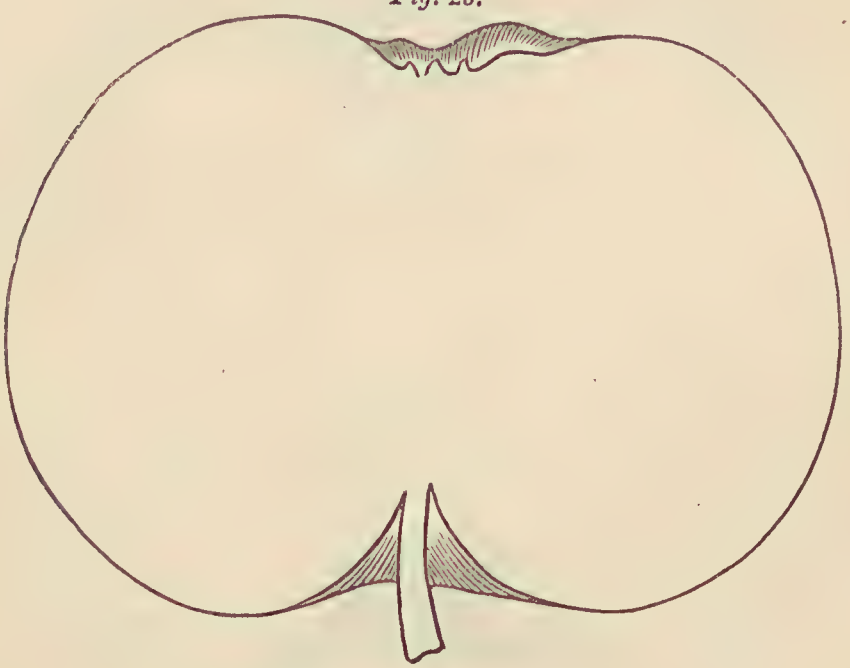
Lord Suffield.—*Fig.* 24.

Fruit.—Large, conical, evenly and handsomely shaped. *Color.*—Pale canary, with a deeper tinge on the exposed side. *Stalk.*—usually very short and stout, inserted in a broad deep cavity. *Eye.*—Very small and closed for so large a fruit, placed in a small shallow plaited basin. *Flesh.*—White, crisp, very juicy, and briskly acid. *Foliage.*—Large and abundant. *Wood.*—Bright brown. *Habit.*—Shoots upright, and of short stout growth. *Tree.*—Half-spreading and compact. *Season.*—About middle of January near Melbourne. The tree is of English origin and a good bearer, but much subject to blight; the evenness of its fruit is a considerable recommendation as a culinary apple. The plate is somewhat larger than ordinary size.

London Pippin (Syn., Five-crowned Pippin).—*Fig.* 25.

Fruit.—Above medium. *Shape.*—Roundish, much flattened, with five distinct angles, which terminate in five distinct knobs or crowns round the eye. *Color.*—Deep clear yellow, sometimes with a tinge of brown next sun. *Stalk.*—About half an inch long, slender, inserted in a deep, funnel-shaped, russety cavity. *Eye.*—Closed, small, placed in a shallow knobbed basin. *Flesh.*—Yellowish-white, crisp, firm, yet tender when quite ripe, very juicy, with a rich and exceedingly

Fig. 25.



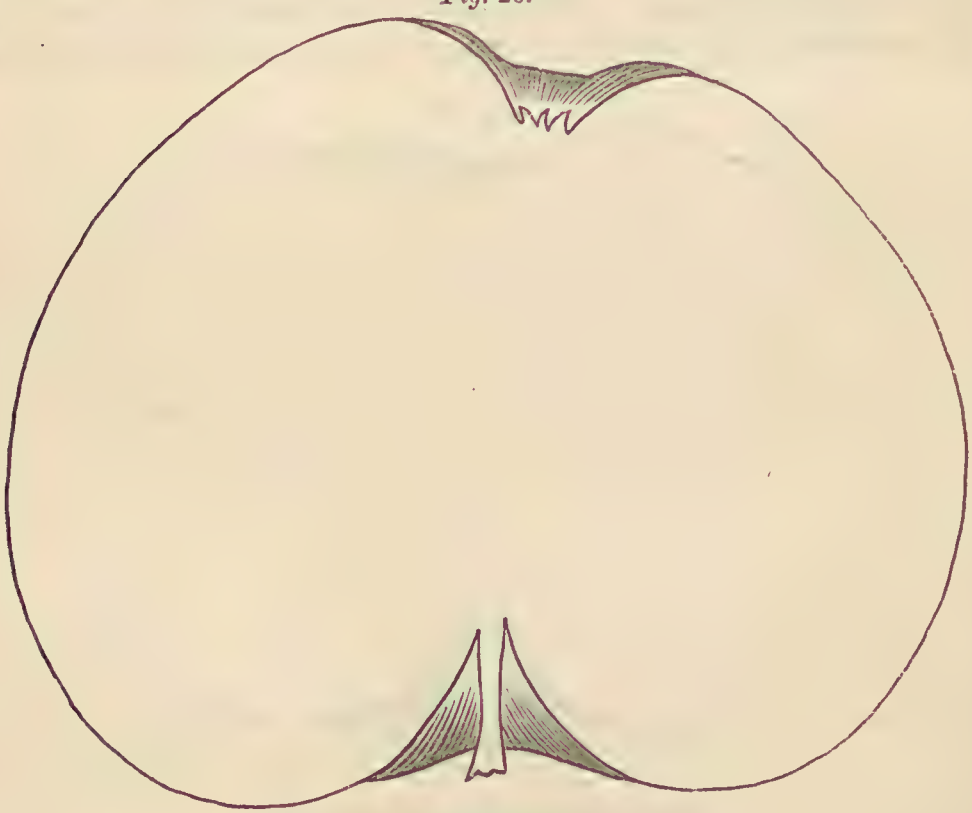
London Pippin (Syn., Five-crowned Pippin).

pleasant flavor. *Foliage.*—Not large, downy, and a good deal incurved. *Wood.*—Pale brown. *Habit.*—Spreading, of stout robust growth. A very old and highly-esteemed English apple, used either for cooking or dessert purposes, and keeps well without shrivelling. The tree is a good bearer, having its fruit very equally divided throughout the tree, similar to Gravenstein. For many years past, and indeed by several growers at the present time, the Dumelow's Seedling or Wellington Pippin is called London Pippin. The two apples are quite distinct; the five knobs on the former are not nearly so prominent as in the London Pippin, and in other respects these two apples are quite dissimilar. It is not very subject to blight.

Melon Apple.—*Fig.* 26.

Fruit.—Above medium, or large. *Shape.*—Roundish and flattened, with obscure ribs running towards the eye, broad at the base. *Color.*—Pale yellow, almost entirely covered with pale crimson, overlaid with broken stripes of darker crimson. *Stalk.*—Usually about half an inch long, slender, inserted in a wide deep russety cavity. *Eye.*—Small, nearly closed, placed in a deep, furrowed basin. *Flesh.*—Yellowish-

Fig. 26.



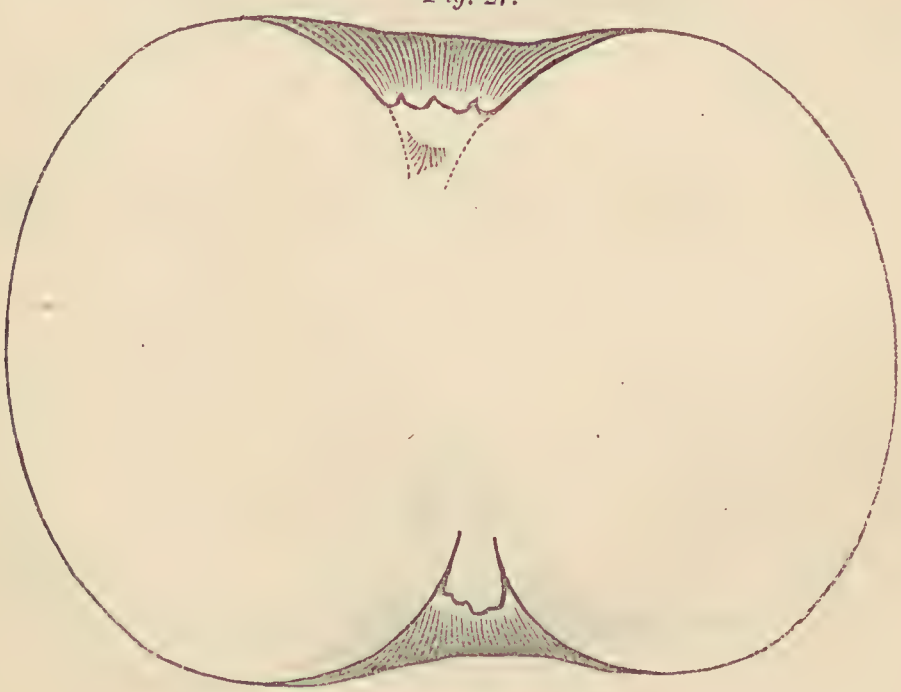
Melon Apple.

white, very tender, but brittle, juicy, and rich, with a refreshing vinous flavor. *Foliage.*—Pale green, late in breaking into leaf in the spring. *Wood.*—Pale brown and very spotted. *Habit.*—Shoots, upright tendency. *Tree.*—Spreading. *Season.*—April. A handsome dessert apple, of American origin; and, like most of our fine apples, is much subject to blight. It does not keep long.

Newtown Pippin (Yellow).—*Fig.* 27.

Fruit.—Medium, or above medium, sometimes large; I have seen it $3\frac{1}{2}$ inches wide. *Shape.*—Roundish, and much compressed at the ends; obscurely ribbed when of medium size; when large, distinctly five-sided and oblique. *Color.*—Skin smooth, usually grass-green till after it is gathered, when it becomes a bright yellow; has always a thin crust of brown russet round the base of the fruit near the stalk, and sometimes a reddish-brown cheek where exposed. *Stalk.*—Short, inserted in a rather deep angular cavity. *Eye.*—Small, and usually closed in a medium-sized fruit; when the fruit is large, quite open, as will be seen by the accompanying plate. *Flesh.*—Yellowish, very firm, crisp, juicy, very richly flavored, and has a fine aroma. *Foliage.*—Pale green, not downy. *Wood.*—Greenish-brown, very spotted, and slightly downy. *Habit.*—Shoots upright and vigorous, tree spreading. *Season.*—From April, and continuing through the winter. An apple of

Fig. 27.



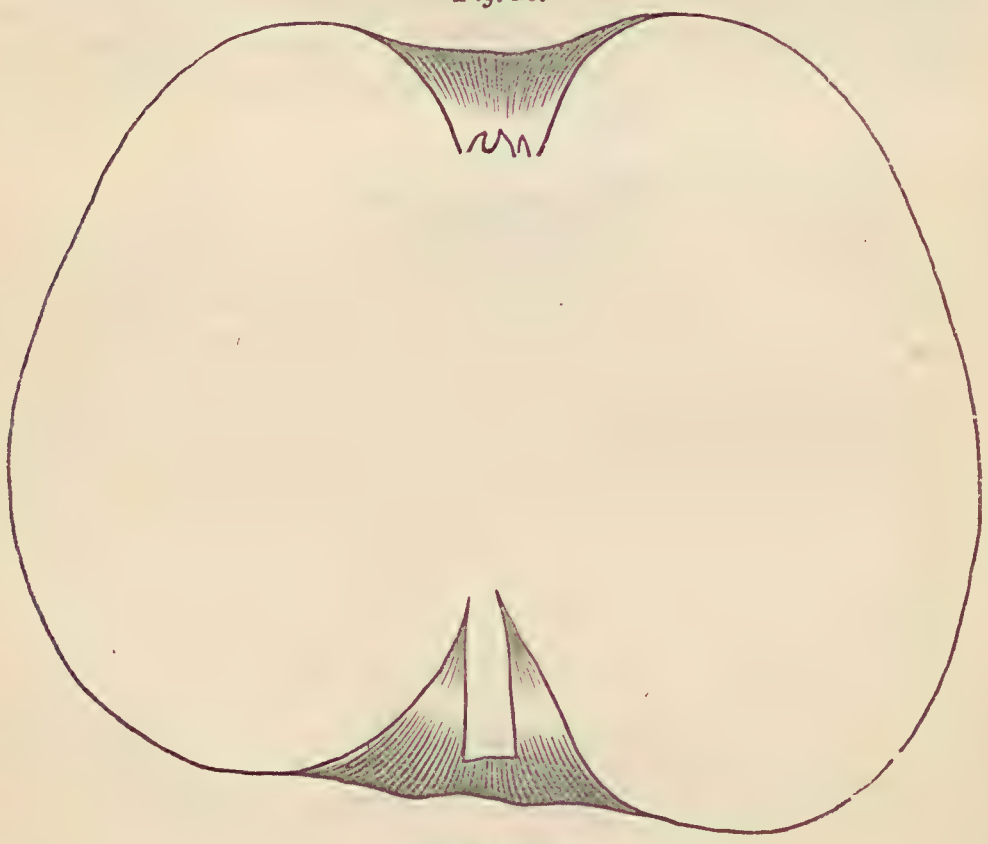
Newtown Pippin (Yellow).

the very highest excellence as a dessert fruit. It requires high cultivation to bring it to perfection. There is a variety called the Green Newtown Pippin, equal if not superior to this, which has been only recently introduced into the colony. Tree a good bearer, bearing its fruit on short spurs on the thicker branches of the tree.

Northern Spy.—*Fig.* 28.

Fruit.—Large, slightly conical, and angular, broader than it is high, but when of medium size assumes a roundish-oblate form. *Color.*—Yellow, washed, and striped with crimson, overlaid with darker stripes of rich crimson, and covered with a rich purplish bloom. *Stalk.*—About an inch long, inserted in a deep and rather angular cavity. *Eye.*—Nearly closed, placed in a deep-furrowed basin. *Flesh.*—Yellowish-white, crisp, and brittle, till when quite ripe, when the flesh becomes tender, very juicy, rich, and of a delicious aromatic flavor. *Foliage.*—Large, dark green, and glossy. *Wood.*—Purplish-brown and spotted. *Habit.*—Upright, handsome, and very vigorous. *Season.*—From April to June. A most beautiful dessert apple, of American origin. It has, however, one drawback, that of being a shy bearer compared with many of our

Fig. 28.



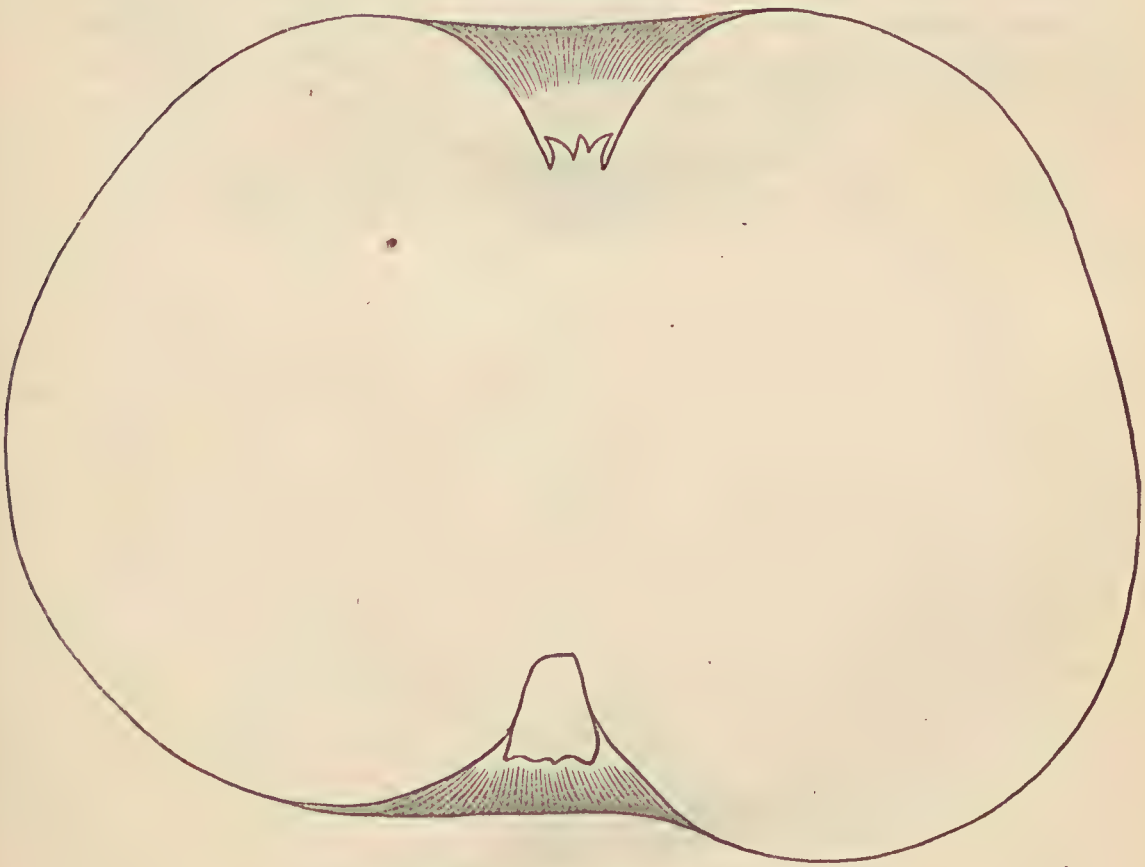
Northern Spy.

fine varieties. It requires careful pruning. The lateral shoots should be encouraged, and not headed back. It will be necessary, however, to head down the leading shoots, or tie them down, in order to check their upward growth. Notwithstanding its shy bearing, the Northern Spy is fast becoming one of our most popular kinds; firstly, from its being thoroughly blight-proof; and, secondly, I believe, from the fact that it is likely to prove one of our best blight-proof stocks. Present experience has proved it a decided success as such. The success with which apple culture is now being carried on is due, in a great measure, to the introduction and popularising of this variety, the Winter Majetin, and one or two other blight-proof kinds. It has given new life and energy to cultivators. A Ribston Pippin tree with clean healthy roots is an attainment gardeners did not expect to arrive at a few years ago.

Reinette du Canada.—*Fig.* 29.

Fruit.—Very large. *Shape.*—Conical and much flattened, broad at the base, and very angular. *Color.*—Greenish-yellow, with a brownish-red tinge where exposed. *Skin.*—Rough to the feel, and strewed with

Fig. 29.



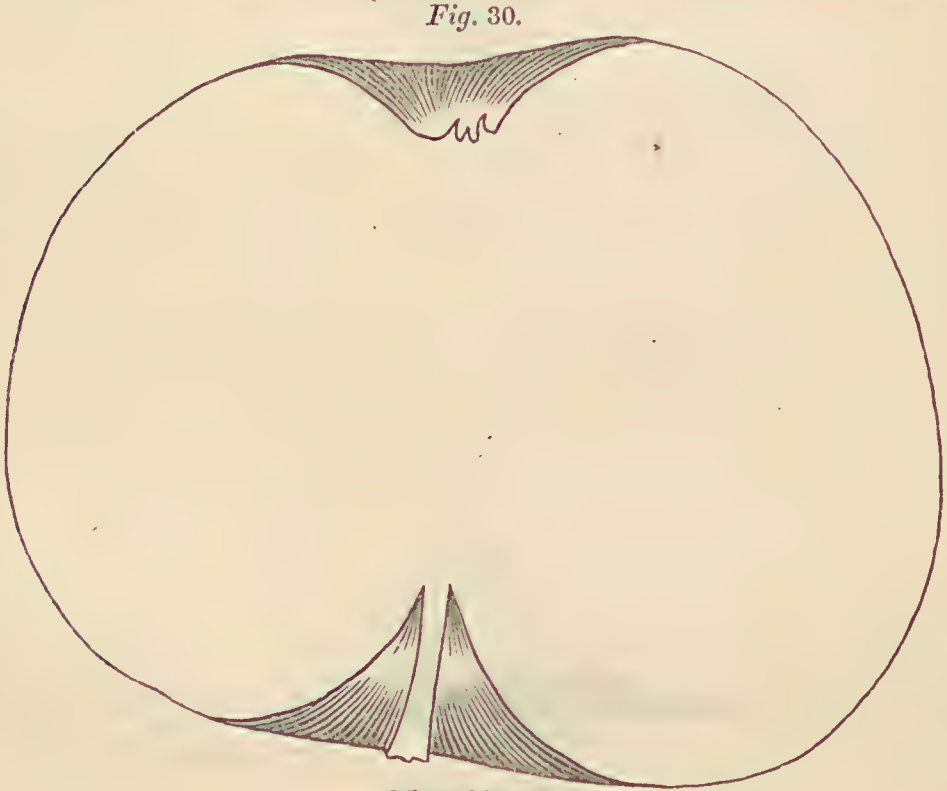
Reinette du Canada.

large russet dots and with patches and tracings of russet. *Stalk.*—Short, inserted in a broad, deep, irregular russety cavity. *Eye.*—Small, closed, or nearly so, placed in a deep angular basin. *Flesh.*—Whitish, firm, fine-grained, brittle, very juicy, sub-acid, rich, and aromatic. *Foliage.*—Large, roundish, downy, with very downy serrated edges, late in coming into leaf in the spring. *Wood.*—Dark, spotted, and downy. *Habit.*—Spreading and vigorous. *Season.*—From March to June near Melbourne. A highly esteemed and popular cooking apple; it is also valuable for dessert, but its large size is against it as a table fruit. Worthy of extensive cultivation. The tree is less liable to blight than many of our fine apples.

Ribston Pippin.—*Fig.* 30.

Fruit.—Medium size, sometimes larger. *Shape.*—Roundish, flattened, broad at the base, somewhat irregular, being obscurely ribbed. *Color.*—Skin greenish-yellow, changing as it gets quite ripe to golden-washed and striped with red, frequently much covered with tracings and patches of russet, and where much exposed often becoming quite crimson. *Stalk.*—Usually from half to three-quarters of an inch long, slender, and inserted in a deep wide cavity. *Eye.*—Small, closed, placed in an irregular basin. *Flesh.*—Yellow, firm, crisp, fine-grained, juicy, rich, and very aromatic. *Foliage.*—Downy, with downy serrated

Fig. 30.



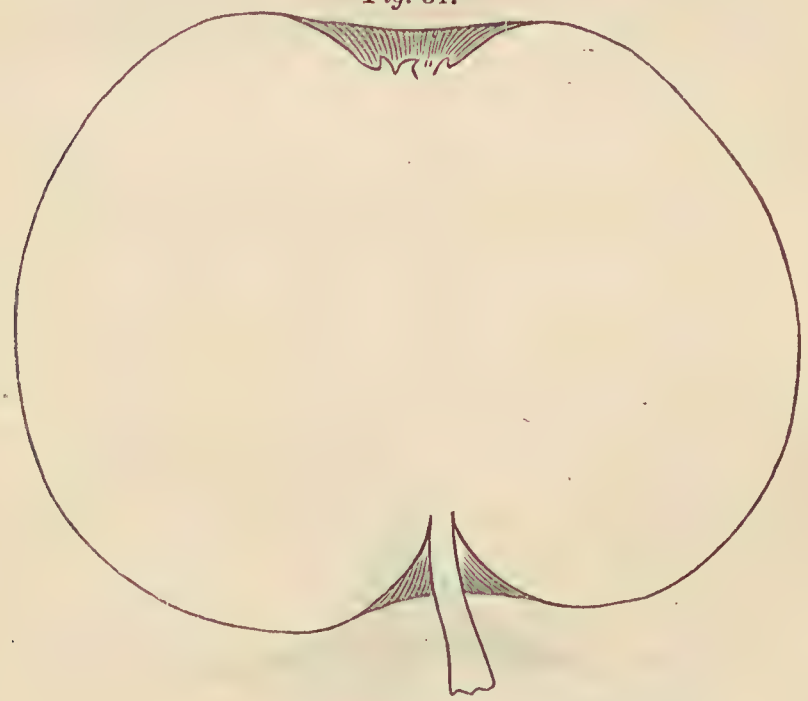
Ribston Pippin.

edges. *Wood.*—Dark and downy. *Habit.*—Spreading. An old and highly esteemed dessert apple; the tree is very subject to blight, especially in heavy soils. My experience of this apple is, that it succeeds best in light sandy soils, and in the districts south and south-east of Melbourne; in heavier soils, and further inland, it does not thrive as well. The tree is a regular and early bearer; the fruit is ripe from the beginning of March, and continues in season from one to two or three months, according to the temperature of the locality where grown. This variety was originally found growing at Ribston Hall, near Knaresborough, England.

Scarlet Nonpareil.—*Fig.* 31.

Fruit.—Medium sized, roundish, and flattened, handsome and evenly shaped. *Color.*—Skin greenish-yellow, the exposed portions being almost entirely covered with bright broken red, overlaid with deep crimson stripes, and covered with numerous specks, frequently russety round the stalk. *Stalk.*—Long, not stout, deeply inserted in a narrow cavity. *Eye.*—Closed, except when the fruit attains to a large size, when the eye is much open. *Flesh.*—Yellowish-white, firm, exceedingly juicy, and of first-rate quality. *Foliage.*—Leaves narrow. *Wood.*—Dark-brown and spotted. *Shoots.*—Upright. *Tree.*—Spreading and handsomely shaped. *Season.*—Beginning of April, and lasting during the winter, near Melbourne. Considered on all points, this variety is

Fig. 31.



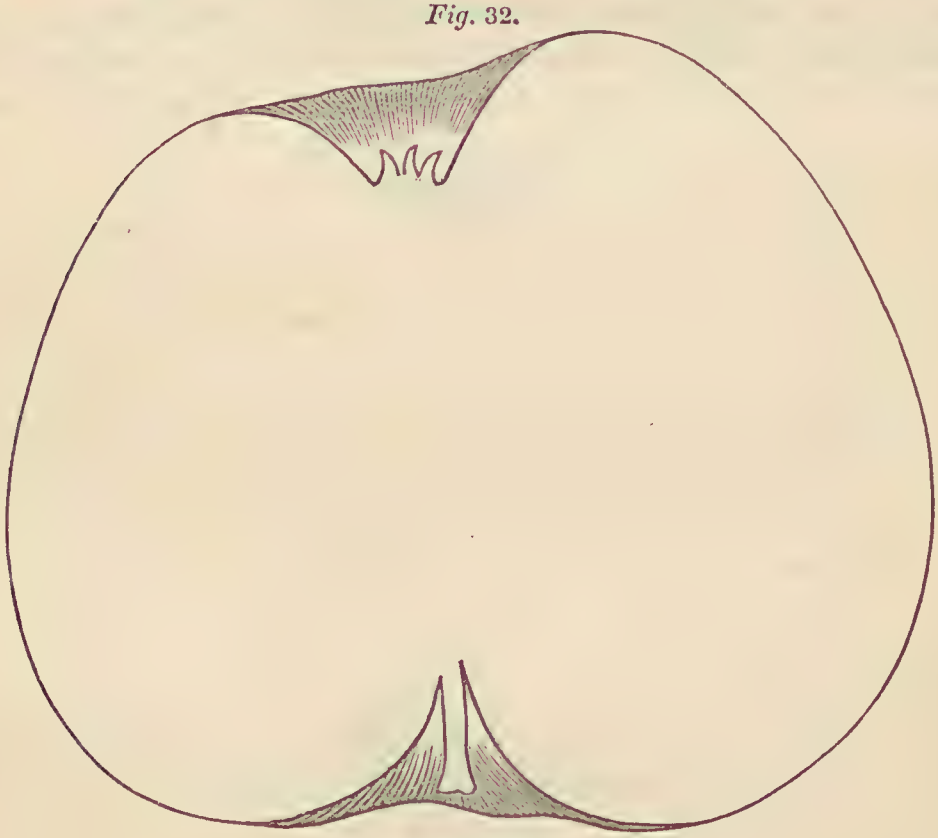
Scarlet Nonpareil.

certainly one of the finest dessert apples in the colony. The tree is a prodigious and early bearer. The size of the fruit is a recommendation; it is handsome, and possesses first-rate keeping properties, and should be in every collection; it has, however, a serious drawback, being rather subject to blight.

Stone Pippin.—*Fig.* 32.

Fruit.—Above medium, sometimes large. *Shape.*—Roundish oval—or globular, very slightly angular. *Skin.*—Smooth, pale yellow, with a reddish-brown cheek where exposed, thinly strewed with russet specks, and with embedded pearly specks. *Stalk.*—From half to three-quarters of an inch long, slender, inserted in a deep funnel-shaped cavity. *Eye.*—Quite closed, placed in a deep evenly-shaped basin. *Flesh.*—Yellowish, firm, crisp, juicy, and briskly acid. *Foliage.*—Pale, large, and very downy underneath; the leaves are incurved, which gives the tree a distinct white appearance. *Wood.*—Dull brown and stout. *Shoots.* — Upright. *Tree.* — Half-spreading, compact, vigorous, and handsome. *Season.*—From March, and during the winter. One of the most valuable apples in cultivation. It is a good bearer, hangs well on the tree, always sells well, is a first-class cooking fruit, and moderate

Fig. 32.



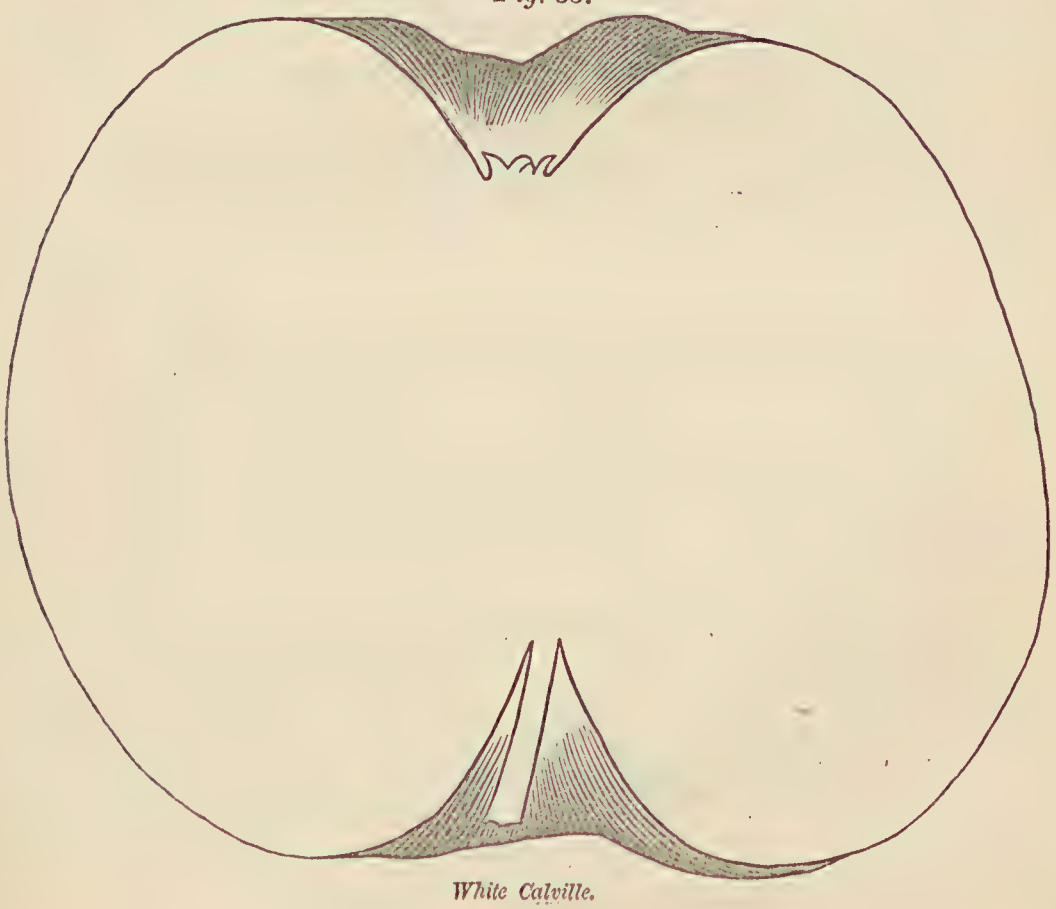
Stone Pippin.

for dessert late in the season. Should be in every collection. The tree is subject to blight, but not so much so as several kinds. The plate is from an extra-sized specimen.

White Calville.—*Fig.* 33.

Fruit.—Large, conical, very prominently ribbed, with angles running from the stalk, and deepening nearer the eye. *Skin.*—Smooth and shiny. *Color.*—Rich, deep yellow, with sometimes a tinge of reddish-brown on side next the sun. *Stalk.*—Three-quarters of an inch long, thin, deeply inserted in a ribbed cavity. *Eye.*—Partially closed, placed in a deep furrowed basin. *Flesh.*—White, tender, with a sweet rich juice. *Foliage.*—Pale green; late in coming into leaf in spring. *Wood.*—Bright brown. *Habit.*—Spreading, with but few lateral branches. *Season.*—April, and continues through the winter. A valuable apple, suitable either for dessert or cooking. The fruit is borne on spurs up the thicker limbs of the tree. In France and England this variety is highly esteemed, especially as a late dessert fruit. Here it is not such a favorite. It requires good soil and cultivation to grow it above medium or large, and unless it grows to a good size, its quality will not be up to the standard.

Fig. 33.

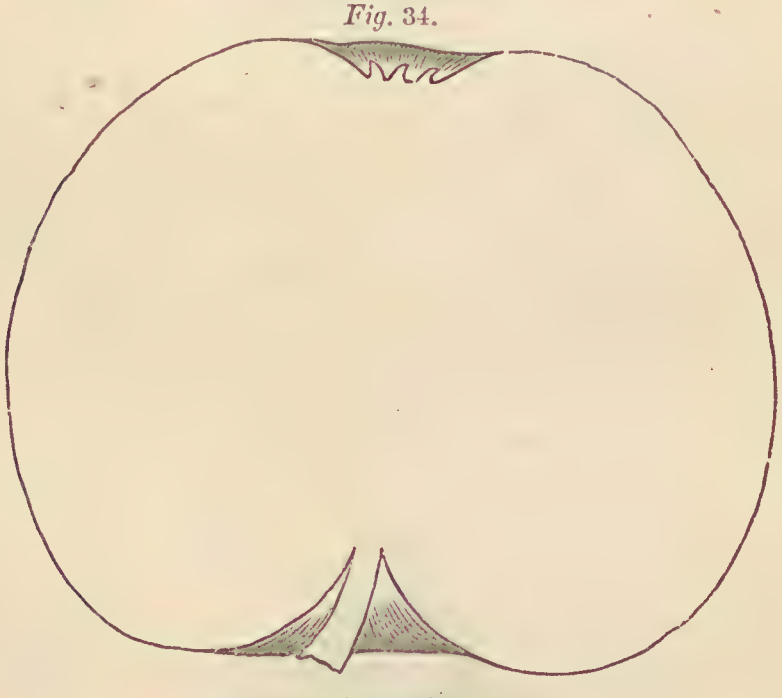


White Calville.

Winter Majetin.—*Fig.* 34.

Fruit.—Above medium size. *Shape.*—Roundish oval, evenly and handsomely formed, with slight angles near the eye. *Color.*—Skin, greenish-yellow, with a brownish-red cheek where exposed to the sun. *Stalk.*—From half an inch to an inch long, deeply inserted in a narrow even cavity. *Eye.*—Rather small, nearly closed, placed in a shallow, plaited basin, with long reflexed segments. *Flesh.*—Yellowish-white, tender, juicy, and briskly sub-acid. *Foliage.*—Large, bending downwards in a regular curve ; very late in coming into leaf in the spring. *Wood.*—Very bright brown and spotted. *Habit.*—Spreading ; the fruit is often borne on the points of the lateral shoots. *Season.*—April to July and August. No apple perhaps has attained so quickly a world-wide reputation, or emerged so quickly from comparative obscurity, than the one under consideration. Messrs. T. Lang and Co. did the colony good service when they introduced this apple as a blight-proof stock. As yet, at least so far as my experience goes, this apple has proved a good stock. It is of quite a different character from the Northern Spy. But, irrespective of its merits as a blight-proof stock, it is a really good apple, and is beginning to establish its reputation as such, though it is not as heavy a bearer as some other varieties. It is a fair dessert fruit, and as a cooking apple it cannot be excelled. The accompanying plate is from a well-grown specimen, about the average size.

Fig. 34.



Winter Majetin.

Richmond Nursery.

AGRICULTURAL SHOWS OF THE YEAR.

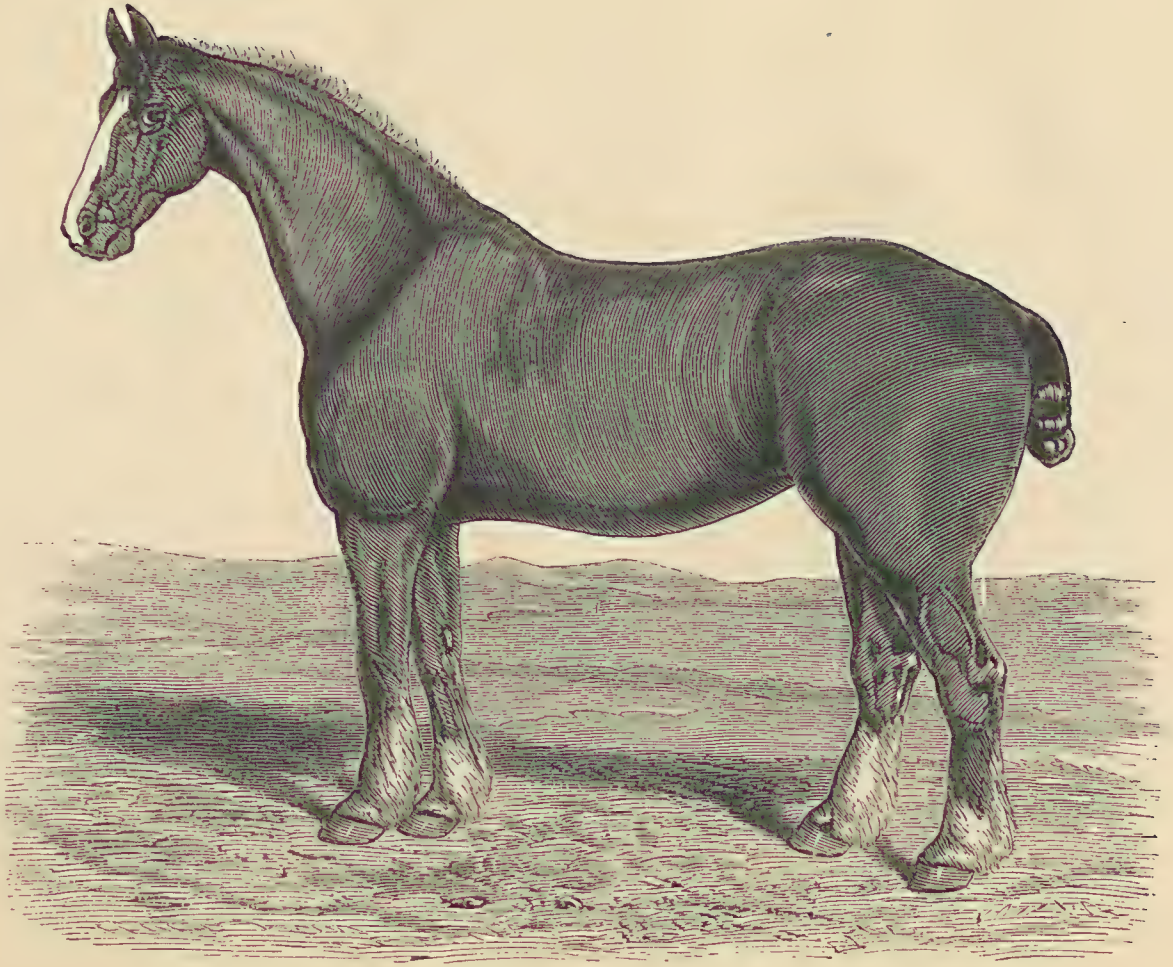
By the Secretary for Agriculture.

The exhibitions held by the leading agricultural societies during 1873 were equal—perhaps superior on the whole—to those held by them in any previous year. The most striking change which these exhibitions one and all displayed, was the marked increase in the number of sheep shown, particularly as regards the long-woolled breeds, and the obvious decline in the entries of implements and machinery—a change which represents in the strongest manner possible the alteration which gradually, though surely, is taking place in the districts which these societies represent. The old, exhaustive, spendthrift course of cropping is giving place to a more rational system of husbandry. The farmer no longer needs, in the same degree, the aid and intervention of the machinist, but seeks to renovate his land, and to work it at a less cost, by the introduction and grazing of sheep and cattle on his farm. The increase in the area laid down in English grasses in the older settled districts, strikes one forcibly when passing through them—fields which but two years since waved with their crops of corn, unfortunately too deficient in bulk, now present uniform green swards of luxuriant pasturage, feeding flocks of well-bred long-woolled sheep, and herds of robust cattle. This change is most welcome to Victorian agriculture, and should prove beneficial to the inhabitants of the districts, and profitable to the occupants of the land. It is one of those changes which are brought about, not by any great application of intellect or industry on the part of those persons whom it most closely concerns, but rather by an exigency of the times. It is one of those changes rendered necessary by the natural laws which govern the fertility of soils; and the sooner the other worn-out lands of the colony undergo the same metamorphosis, the better for the farmer and the community at large.

Smeaton, Spring Hill, and Bullarook Agricultural Society.

The national exhibition, held under the auspices of the Department of Agriculture and in connexion with the above-named society, on the 13th and 14th of November 1873, proved a marked success. The first day, as usual, was devoted to the judging of the entries in the implement and machinery sections, and had little interest for those whom

these exhibits did not immediately concern. On the second day, the stock, dairy produce, poultry, and other exhibits, including implements and machinery, were shown. As was anticipated, the sections for the two last-named articles were not well filled, though the quantity of heavy machinery shown surpassed expectations. The Smeaton show-yards are too distant from a line of railway, and too far removed from the centres of manufacture, to warrant machinists in exhibiting largely at the show of the district society. Two so-called reaping and binding machines were on exhibition, or rather one machine ready to take the field, and one model. Neither, however, was satisfactory, both falling far short of the standard of excellency required in such labor-saving appliances. The stock sections were admirably represented. The show of horses embraced 251 animals of all kinds, of which upwards of one-half were included in the draught-stock sections. The any age draught entries were fewer in number than is usual at an exhibition of this society, though the quality of the animals paraded was quite equal to that of any previous year. The highest honor was awarded to Mr. W. T. Cox's "Pride of Scotland," Mr. Peter Gordon's "Wallace" being placed second, and Messrs. Pickering and Bradshaw's "Jack's the Lad" third. The section for draught mares in foal, or with foal at foot, was pronounced by all present to be the best which the colony has seen. It embraced eleven entries, all of which were represented by animals of high merit, but some by superior stock—stock which has occupied premier positions at the principal shows of Scotland as well as of this country. The judges awarded the first prize to Mr. W. McCulloch's "Glasgow Maggie," and the second to the same gentleman's mare "Strathblane Mary," both imported animals. The third prize was given to Mr. W. T. Cox for his mare "Princess of Wales," while an honorable certificate was granted Mr. J. Smith, for "Princess Maud 8th." "Glasgow Maggie" is now seven years old. In 1872 she was exhibited at the meeting of the Highland and Agricultural Society at Kelso, and likewise at the Wigtown County Show, and gained first prize in both instances. Shortly after being landed in Victoria, she was shown at the annual exhibition of the Victoria Agricultural Society, and was placed second to "Strathblane Mary." She was next shown at the meeting of the National Agricultural Society, held at Melbourne on the 22nd, 23rd, 24th, and 25th of October 1873, and received first prize, and likewise the silver cup, for the best mare in the yard. At the National Exhibition held in connexion with the Smeaton Agricultural Society she was placed first in a good class; and, subsequently, she was awarded similar honors at the shows of the Kyneton Agricultural Society



CLYDESDALE MARE, "STRATHBLANE MARY."

Property of Mr. W. McCulloch, *La Rose, Victoria.*

SHORTHORN BULL, "FIFTH DUKE OF BRUNSWICK," AT 11 MONTHS.

Bred by Mr. R. Morton, *Mount Derrimut, Victoria.*

1873, and the Victoria Agricultural Society 1874. "Strathblane Mary," like "Glasgow Maggie," is seven years old. She was never exhibited before being shipped to this country. Shortly after her arrival in Victoria, she received first prize at the meeting of the National Agricultural Society, held at Melbourne in November 1872, and also the medal for the best mare in the yard. She was next exhibited at the show of the Victoria Agricultural Society, held at Heidelberg in April 1873, and was placed first, beating "Glasgow Maggie." Subsequently, however, wherever these two mares have met, "Glasgow Maggie" has always been placed by the judges before "Strathblane Mary." As both these animals are deemed of superior merit, illustrations, taken from original drawings supplied by Mr. W. McCulloch, are given of them. The cattle class was well represented, particularly as regards the shorthorn sections. The section for any age imported of colonial shorthorn bulls contained only three exhibits. The first prize was awarded to Branigan Brothers, for "Gipsy Boy," by "Frederick Fitzbooth;" the second to Mr. Wilson Tyson, for "2nd Duke of Lancaster," by "Duke of Brunswick." "Gipsy Boy" is an imported animal. The yearling shorthorn bull section, however, was the best section in this division of the show. The first prize was awarded to Mr. Richard Morton's bull "5th Duke of Brunswick," roan, by "Duke of Brunswick," dam "Matilda 2nd;" the second to Mr. Thomas Ellwood's "Athelstane," by "Donald Caird." "5th Duke of Brunswick's" career in the show-yards of this and the neighboring colony of New South Wales, has been a most brilliant one. He was first exhibited as a calf, nine months old, at the show of the National Agricultural Society, held at Melbourne in October 1873, and was awarded first prize, beating several animals of high merit. He was next shown at Ballarat on the 5th November 1873, and carried away the first prize for shorthorn bulls under three years; at Smeaton, on the 14th November 1873, he took the first prize in the yearling shorthorn bull section, and likewise the Champion prize. At Sydney he was awarded the first prize in the yearling section, and also the breeders' subscription prize; and was pronounced to be one of the best bulls ever landed in New South Wales. He was subsequently purchased at auction, by Mr. W. W. Ewing, of Ulladulla, for 1150 guineas. "Fifth Duke of Brunswick" was calved 29th January 1873. An engraving of this animal from a drawing made by Mr. R. Shepherd, of the Mines Department, is published with this description. For shorthorn cows, Mr. Richard Morton obtained the first prize with "Matilda 4th;" Messrs. Anderson Brothers the second. In the three-year-old shorthorn heifer section, Mr. R.

Morton gained first honors with "Duchess of Brunswick;" Mr. James Sewell second with "Butterfly 21st." For two-year-old shorthorn heifers, Mr. R. Morton obtained the first prize with "Triple's Brunswick," and second with "2nd Duchess of Derrimut." Like "5th Duke of Brunswick," the show-yard career of "Triple's Brunswick" has been most brilliant. She was first shown as a calf at Heidelberg in March 1873, and gained first prize. She was next exhibited as a yearling at the show of the National Agricultural Society, held at Melbourne in October 1873, and was awarded the highest honor. At Ballarat, on the 5th November 1873, she was placed second to "2nd Duchess of Derrimut," also the property of Mr. Morton. At Smeaton, the week following, she gained first prize, being shown as a two-year-old; also the Champion prize for the best female in the shorthorn sections, and the society's challenge cup, having won it for the first time. The Smeaton society's challenge cup must be won twice in succession before it can be claimed. At Sydney she was awarded the first prize in the yearling section, also the breeders' subscription prize, and the Champion prize for the best female of any age or breed in the yard. Very high offers, it is understood, were made for this animal by New South Wales breeders, but none were satisfactory to the owner, and she was brought back to Victoria. "Triple's Brunswick," roan, calved 12th July 1872, is by "Duke of Brunswick" or "Duke of Derrimut,"* dam "Triple Butterfly." An engraving of "Triple's Brunswick," from a drawing also made by Mr. R. Shepherd, is published with this account. Herefords were fairly represented, and the different sections contained animals of average merit. Ayrshires and Alderneys were likewise shown in fair number. In the section for the best dairy cow of any breed, twenty entries were catalogued, most of which competed. The first prize was awarded to Mr. James Malone, the second to Mr. John Crook, the third to Mr. Joseph Hillman, and the fourth to Mr. William Rickey. The display of sheep, more particularly of the long-woolled breeds, was highly creditable to the society, and in this particular the spring show of 1873 excelled any exhibition previously held under its auspices. In the sections for merino or Saxon sheep, Mr. Alexander Armstrong, of Warrambeen, was the principal prize-taker. The first prize for Leicester rams, four-tooth and upwards, was awarded to Mr. Alexander Armstrong; and the first prize for two-tooth sheep of the same breed and sex to Mr. Thomas Bath, of Ceres. The first prizes for Leicester ewes, both in the four-tooth and two-tooth sections, were granted to Mr. Alexander Armstrong. The Champion

* "Duke of Derrimut," by "Duke of Brunswick" (25,937), dam "Roan Duchess," by "Royal Butterfly 6th" (18,757).

SHORTHORN HEIFER, "TRIPLE'S BRUNSWICK," AT 17 MONTHS.

Bred by Mr. R. Morton, *Mount Derrimut, Victoria.*

prize for the best Leicester ram in the yard was awarded to Mr. Thos. Bath, and for the best Leicester ewe to Mr. Alexander Armstrong. Cotswold rams were exhibited by Mr. Alexander Armstrong, who gained the first and second prizes in the section. The first prize for the best Lincoln ram, four-tooth and upwards, was awarded to Mr. Thos. Bath, for an imported sheep; and for the best two-tooth sheep of the same breed and sex to Mr. Edward Birch, of Bullarook, also for an imported animal. Mr. John Richardson, of Newlyn, carried away the first prize for Lincoln ewes, four-tooth and upwards, with imported sheep; and Mr. Edward Birch the first prize for two-tooth Lincoln ewes, also with imported animals. The Champion prize for the best Lincoln ram in the yard was awarded to Mr. Edward Birch, and for the best ewe of the same breed to Mr. John Richardson. Pigs were few, but of good quality. Poultry was fairly represented. Dairy produce was exhibited in considerable quantity, and the quality of the exhibits was likewise, as a rule, above average merit. There were also a number of miscellaneous articles shown, including home-made bread, jams, &c., &c. The show was attended by large numbers of persons, and was visited, on the second day, by His Excellency the Governor and several members of the Ministry. Although not held in close proximity to any large centre of population, the show proved as successful in attracting spectators, as in concentrating around one centre some of the best stock and produce of Victoria, and it may be said to have fully served the object for which such exhibitions are held—viz., to instruct agriculturists, by the comparison of their animals and produce with those of their neighbors, and also with those of persons who reside at comparatively long distances.

The Geelong and Western District Agricultural and Horticultural Society.

This society held its annual exhibition at Geelong on the 16th October 1873. The main feature of the show, was the marked increase in the number of sheep exhibited, particularly of the long-woolled breeds; indeed it was noticeable that, where the merino in former years took precedence of the long-woolled varieties, these latter kinds this year outstripped the merino in numbers, and showed great improvement in quality. There were only two exhibitors of merinoes, viz., Mr. Alexander Armstrong and Mr. A. M. Campbell, the first-named of whom this year was the most successful prize-taker, though on former occasions that honor has usually fallen to the lot of Mr. Campbell. The exhibitors of long-wools could be

counted by tens. The prizes in the different sections were divided among some of the principal breeders of these varieties in the colony. Horses were poorly represented as regards numbers, though the quality of some of the draught stock was of high merit. The cattle exhibits fell below the average of the shows held annually under the auspices of this society, the absence of animals from the herds of our principal breeders having been much felt. The dairy stock, however, was equal to that shown on former occasions; and some fine fat cattle were also exhibited. The show of implements was sparse, having been limited principally to the display of ploughs, harrows, and reaping machines. Pigs were few in number, but average in quality. Poultry was equal to the shows of former years. Butter and cheese were exhibited in considerable quantity, while the quality of the entries was, perhaps, above average. A great feature in the exhibition of this society is the display of vegetables and flowers which is annually brought together; and the show of this year did not fall below those of former occasions in this particular. The horticultural section of the Geelong exhibition seems to add greatly to its attraction, and not in a less degree to its usefulness.

The National Agricultural Society of Victoria.

The above society held its third annual spring show at Melbourne on the 22nd, 23rd, 24th, and 25th of October 1873. The exhibition was a decided improvement upon the shows previously held under its auspices. The main feature of the show of the National Agricultural Society is the number and quality of the exhibits of implements and machinery which it brings into competition. Located, however, as this society is, in the metropolis and centre of manufacture, it can be readily understood that it must always command a more general and better display of these articles, than any of the up-country societies. The long line of threshing machines and portable engines, all in work, was truly a grand display, such, perhaps, as could be seen in no other town south of the line; and the number of other exhibits scattered over the show-yard formed a spectacle equally rare in the Southern Hemisphere. A new and improved plan, by which each manufacturer is enabled to obtain a certain area of ground for the display of all his exhibits, was adopted this year for the first time by the National Society. A similar plan has been followed by the Royal Agricultural Society of England for many years, with the best results. This last-named society, however, selects for special trial each year a certain description of implement or machine, due notice of its intention having been previously given, and awards special prizes for

such exhibit. This plan might be pursued with advantage by our National Agricultural Society. The show of draught-horse stock was sparse; but this was owing to the plan lately adopted by this society of holding a special exhibition of draught entires in the month of August, such an exhibition in October interfering too materially with the travelling season. The show of cattle was excellent. The shorthorn pens were well filled, for the most part, with noble occupants. The principal prizes were carried off by our two leading breeders, Mr. Robert McDougall and Mr. Richard Morton. The first-named gentleman obtained first prize in the two-year-old shorthorn bull section with "Ajax Booth," the latter the first prize in the section for one-year-old shorthorn bulls with "5th Duke of Brunswick." "Ajax Booth," roan, calved 11th May 1872, is by "Field Marshal Booth" (28,595), dam, "Alhambra," sire of dam "Count of the Empire" (222), and was bred by the exibitor. In the section for aged bulls, the second prize was allotted to Mr. Hall of Kyneton, for "Young Victor;" no first prize was awarded. For three-year-old shorthorn bulls Mr. W. McCulloch, of La Rose, gained first honor with "Royal George," roan, by "Royal Broughton" (27,352), dam "Industry;" Mr. Joseph Riddell, of Romsey, second, with "My Lord," roan, by "Conquerer" (25,823), dam "Lady." In the section for shorthorn cows, Mr. Robert McDougall gained the first, second, and third prizes with "Cleopatra," "Legacy," and "Solus Speur." "Cleopatra," light roan, calved 2nd October 1867, is by "Count of the Empire" (222), dam "Cowslip 9th," sire of dam "Royal Hope" (187), and was bred by the exhibitor. For three-year-old heifers, Mr. Richard Morton received first prize for "Grand Duchess of Derrimut;" Mr. J. Chappel, of Rochester, second for "Matilda's Butterfly;" and Mr. Richard Morton third for "Duchess of Brunswick." "Grand Duchess of Derrimut," roan, calved 10th March 1871, is by "Duke of Brunswick" (25,937), dam "Roan Summerton," and was bred by the exhibitor. For two-year-old heifers, Mr. Richard Morton gained first prize with "3rd Duchess of Derrimut;" Mr. Robert McDougall second with "Solus;" and Mr. R. Morton third with "Red Rose the Second." "Third Duchess of Derrimut," rich roan, calved 5th October 1871, is by "Duke of Brunswick" (25,937), dam "White Summerton," and was bred by the exhibitor. For yearling shorthorn heifers, Mr. Richard Morton obtained first prize with "Triple's Brunswick;" Mr. J. Horwood, of Bridgewater, second; and Messrs. P. and J. G. Brisbane, of Berwick, third. The prizes for the best bull and best cow in the yard were awarded to Mr. Robert McDougall for "Ajax Booth" and "Cleopatra;" the latter,

however, after much hesitation and division of opinion on the part of the judges, which rendered the services of a referee indispensable. Mr. W. McCulloch's recently imported prize bull "Rapid" was on exhibition, and was much admired by the spectators, and highly commended by the judges. The Herefords were few in number, but superior in quality, the principal exhibitor and prize-taker being Mr. Henry Beattie, of Mount Aitken. Alderney cattle were well represented; Ayrshires and Brittanys fairly so. Dairy cattle were both numerous and of superior quality. The section for fat bullocks contained some large-framed and monstrously fat animals. Sheep were shown in large number; and at this show likewise the long-wool took precedence of the merino. The principal prize-taker in the merino sections was Mr. James Robertson, of Essendon. In the long-woolled sections the prizes were distributed among many of our principal breeders, the most prominent of whom were Mr. Joseph Austin, Mr. C. B. Fisher, Mr. Alexander Armstrong, Mr. Thomas Hogan, Mr. James Ewart, and Mr. Robert Dawbin. The short-woolled British breeds were poorly represented, none of the animals shown being worthy of special notice. Pigs were shown in fair numbers, and the quality of the exhibits was equal to if not above average. Poultry was sparsely represented, but the quality was good. A number of miscellaneous and extra agricultural exhibits were on view, but these demand no fuller remarks. The show was visited by a considerable number of persons, particularly on the last day; but the society does not receive the public support which its importance should command, a matter much to be regretted.

The Bendigo Agricultural and Horticultural Society.

The above-named society held its annual spring exhibition at Sandhurst on the 29th October. The show was not equal to what an agricultural show should be, when held under the auspices of a society representing so large and important a district as does the Bendigo society. Implements were only sparingly represented; the exhibits comprised principally ploughs, harrows, reaping machines, and strippers. Stock of all kinds were few in number, and, for the most part, inferior in quality. Some moderate draught stock was exhibited, particularly in the section for mares; and a few superior shorthorns were on show. Sheep were poorly represented, and, excepting a few average animals exhibited by Mr. W. Winter and Mr. Slee, the whole was an inferior lot. Pigs were few in number, but average in quality. The show was fairly attended by the public, particularly during the latter portion of the day.

The Ballarat Agricultural and Pastoral Society.

This society held its fifteenth annual spring exhibition in the show-yards, Ballarat, on the 4th and 5th of November 1873, and, though somewhat unfortunate as regards weather, the exhibition passed off exceedingly well, and proved a success, both financially and otherwise. The first day, as usual, was devoted to the judging only of the implements, machinery, and sheep. The second is always the principal day of exhibition with the Ballarat society, when all articles entered for competition are on view. Like the National, the Ballarat society this year adopted the plan of allotting to each manufacturer and exhibitor of machinery a space for the display of all his exhibits; a plan which promises to work to the satisfaction of the society, the public, and the exhibitors; and the example will doubtless be soon followed by the other societies of the colony. On the whole, the show of implements and machinery was, perhaps, superior to that of former years, but a falling off was noticeable in the number of threshing machines on exhibition. The stock classes, for the most part, were well filled. The draught-horse sections comprised some fine animals. The first prize in the section for any age colonial or imported draught entires was awarded to Mr. P. Gordon, for "Wallace;" the second to Mr. D. McIntosh, for "Young Vanquisher;" the third to Mr. W. Ross, for "Scotsman." In the section for colonial or imported draught mare in foal or with foal at foot the first prize was awarded to Mr. J. Smith, for his well known animal "Princess Maude 8th." The first prize in the dry mare or gelding section was awarded to Mr. P. Gordon, for "Maggie." The Champion prize "for the animal in the draught-horse sections which shows the greatest merit and is considered best capable to produce its kind" was taken by Mr. J. Smith, with his mare "Princess Maude 8th." The cattle class was well filled, and embraced several animals of high merit. The first prize for shorthorn bulls, three years and over, was awarded to Messrs. McNaught and Boyd. For shorthorn bulls under three years Mr. R. Morton obtained the first prize, with "5th Duke of Brunswick." In the section for shorthorn cows of any age Mr. R. Morton obtained both the first and second prizes; and the first and second prizes for shorthorn heifers under three years fell to the lot of the same breeder. Herefords were fairly represented, but the quality of the exhibits was only of average merit. Alderneys and Brittanys were also shown, though not in large numbers. Dairy stock was well represented. The first prize for cow calved or in calf was awarded to Messrs. E. and T. Fisher, the second and third prizes to Mr. George Eason. The first and second

prizes for the pen of three cows giving milk was carried off by Messrs. E. and T. Fisher; the third by Mr. John Kent. Sheep were shown in considerable number; but the exhibition seemed slightly to feel the loss of the exhibits which were annually contributed by Mr. Robertson, formerly of Burrumbeet. As in the case of the other societies, the long-wools took precedence of the merino. In the sections for merino or Saxony sheep all the prizes were taken by Mr. Alexander Armstrong, of Warrambeen. The short-woolled British breeds were poorly represented, and call for no special remarks. The long-woolled sections were filled, for the most part, with animals of superior quality. The prize-takers were Mr. Alexander Armstrong, Mr. Thomas Bath, Mr. T. Hogan, Mr. F. Edwards, Mr. Thomas Toy, Mr. J. McPhee, Mr. R. L. Bell, and Mr. Alexander Taylor. The Champion prize for the best long-woolled ram in the yard was awarded to Mr. Thomas Bath. Pigs were shown in considerable number, and the quality, on the whole, was good. The principal prize-takers were Mr. Hillman, Mrs. J. E. Loader, Mr. John Farmer, Mr. S. T. Moyle, and Mr. Thomas Toy. Poultry was largely shown, and the quality of the exhibits was, perhaps, above average. Dairy produce forms an important section of the show, and, for the most part, was excellent in quality. Plants and flowers, colonial liquors, dogs, and a number of miscellaneous articles were also exhibited, and added much to the attractiveness of the exhibition.

The Kyneton Agricultural Association.

The show of this association is usually the last, though by no means the least important, of the annual spring exhibitions of the leading agricultural societies. The 1873 show was held at Kyneton on the 27th November. The principal features in the exhibition were the number and quality of the exhibits of horse-stock and cattle. The sections for draught entires comprised some exhibits of superior merit. The first prize in the any age section was awarded to Mr. A. Watson, for "Champion of Scotland"—a noble animal; the second to Messrs. Pickering and Bradshaw, for "Jack's the Lad;" the third to Mr. Hodge, for "Molyneux." For colonial bred draught entires the first prize was allotted to Mr. E. Fay, for "Young Matchless;" the second to Mr. James Peters; the third to Mr. J. Menzies. For brood mares (imported) the first and second prizes were awarded to Mr. W. McCulloch, for "Glasgow Maggie" and "Strathblane Mary." For brood mares (colonial bred) the prizes fell to Mr. Alex. Bourke, Mr. Anderson, and Mr. J. Cochrane. In the cattle classes shorthorns were well represented. The principal prize-takers were Mr. R. Morton, Mr. J. Tweddle, Mr. James Peters, and

MAP OF
VICTORIA
Shewing position of Meteorological Stations Telegraph, Railway routes etc.
Scale of Miles.
Lithd at the Department of Lands and Survey Melbourne, May, 1874
by Saml B Bonney
Meteorological Stations.
Principal Stations thus
Secondary
Overland
Telegraph Routes
shewn thus
The lines thus shew the direction of the wind during the Gale on the 15th 16th Jany 1857
NEW SOUTH WALES
SOUTHERN OCEAN
Bass' Strait
MILLEWA
WEEAH
KARKAROOC
TATCHERA
LOWAN
BORUNG
KARA KARA
GLADSTONE
GUNBOWER
BENDIGO
RODNEY
MOIRA
BOGONG
BENAMBRA
DELATITE
DALHOUSIE
TALBOT
ANGLESEY
WONNANGATTA
DARGO
TAMBO
CROAJINGOLONG
DUNDAS
RIPON
BOURKE
GRANT
EVELYN
TANJIL
FOLLETT
NORMANBY
VILLIERS
HAMPDEN
GRENVILLE
MORNINGTON
BULN BULN
HEYTESBURY
POLWARTH
MELBOURNE
PORT PHILLIP BAY
CAPE HOWE
Wilson's Promontory
Tasmania
Borneo
Equator
New Guinea
Cardwell
Normanton
Pt Darwin
Adelaide
Sydney
Tropic of Capricorn
WESTERN AUSTRALIA
SOUTH AUSTRALIA
QUEENSLAND
NEW SOUTH WALES
VICTORIA
New Caledonia
Cyclone 13-14 Jany 1857
Boundary with South Australia marked on the ground by Messrs Wade & White

Mr. J. Rennick. Herefords were shown in considerable number, and the quality of the exhibits, as a rule, was above average. The prize-takers in this section were Mr. R. Orr, Mr. J. Neilson, Mr. J. Glen, Mr. Patrick Lyons, Mr. James Peters, Mr. W. Peters, and Mr. Joseph Watson. Ayrshires, Alderneys, Devons, and Brittanys were also fairly represented. The dairy cow section was well filled with animals mostly of high merit. Fat stock and working bullocks were also exhibited. The show of sheep, though an improvement on former years, was not satisfactory. The merinoes were of ordinary merit; but the long-wools, with few exceptions, fell short of the quality exhibited at other shows. Pigs were numerously and well represented. The poultry likewise was a satisfactory section of the exhibition. Dairy produce was very good, as it usually is at Kyneton. Implements and machinery were shown in fair quantity, but call for no special remarks. The show, on the whole, was a marked success, and was well supported by the public. His Excellency the Governor and several members of the Ministry and Legislature visited the show-yards during the day.

The shows of the other societies have not been referred to, owing to it having been found impossible to attend them.

METEOROLOGY OF VICTORIA.

By Mr. R. L. J. Ellery, F.R.S., Government Astronomer.

The colony of Victoria, which has an area of about fifty-six millions of acres, occupies the south-east portion of Australia, and may be said to be included between the parallels 30° and 39° south latitude, and the 141st and 148th meridians. The whole southern boundary is formed by the waters of Bass's Straits, which separate Tasmania from Australia; the northern boundary consists of the River Murray; on the west it is limited by a marked line approximately coinciding with the 141st meridian; while on the east it is separated from the adjacent colony of New South Wales by a line running N. 64° W. from Cape Howe to the nearest waters of the Murray. Its sea-board, lying generally east and west, extends over about 500 miles.

By an examination of a contoured plan of the colony, we find that the most prominent feature is an extensive mountain range running approximately east and west, rising somewhat abruptly about lat. 37° 30′ and long. 141° 40′, varying in altitude from 1000 to 5000 feet, and culminating in the N.E. in lat. 36° 30′, long. 148° 20′, at Mount

Kosciusko, the highest part of the Australian Alps, where it attains an altitude of over 7000 feet. The higher parts of this range are covered with snow for several months in the year. The mountain country is for the most part densely wooded with fine timber, even to the very summits; at some of the higher elevations, however, especially in the N.E., many of the peaks are quite bare, or only partially covered with dwarfed trees or shrubs. The country north and south of this great dividing range is moderately undulating or flat, consisting often of large plains, in some parts quite destitute of trees, but closely wooded in others. Along some parts of the coast line, however, especially in the Cape Otway, Western Port, and Wilson's Promontory districts, the land rises to considerable altitude (from 2000 to 3000 feet) by ranges generally well covered by timber to their summits. On the whole, the country is not well watered; the rivers are few and insignificant, and are often nearly dry in summer; there are several lakes, both salt and fresh, in different parts, but not of sufficient extent to have any marked influence on the climate. The coast line itself is for the most part comparatively flat, with a moderate elevation; although, as just stated, at some places, lofty ranges abut on the sea, and the coast becomes precipitous and rugged.

An extensive sea-board, open to polar winds and oceanic currents, modified, no doubt, by the presence of the island of Tasmania; an extensive and wooded mountain range running across the whole breadth of the colony, the higher portions of which are often clothed in snow; and the generally arid sub-tropical Australian interior, dominating on its northern and western boundary, must each necessarily exercise considerable influence in producing conditions of climate varying with the locality.

From the results of observations made at the localities named below, tables of temperature, humidity, rain, &c., have been deduced, which are given in the following pages :—

	Lat. South.	Long. East.	Elevation above Sea Level.
Melbourne	37° 50′ ...	144° 59′ ...	91 feet
Ballarat	37° 34′ ...	143° 49′ ...	1438 „
Sandhurst	36° 47′ ...	144° 17′ ...	778 „
Beechworth ...	36° 20′ ...	146° 43′ ...	1783 „
Portland	38° 20′ ...	141° 35′ ...	37 „
Cape Otway ...	38° 54′ ...	143° 31′ ...	300 „
Port Albert... ...	38° 39′ ...	146° 41′ ...	30 „
Gabo Island ...	37° 35′ ...	149° 55′ ...	40 „
Ararat	37° 18′ ...	142° 58′ ...	1072 „
Stawell	37° 4′ ...	142° 46′ ...	749 „
Berwick	38° 2′ ...	145° 21′ ...	—
Daylesford	37° 21′ ...	144° 10′ ...	2036 „
Heathcote	36° 55′ ...	144° 42′ ...	789 „
Castlemaine ...	37° 4′ ...	144° 14′ ...	1000 „
Camperdown ...	38° 14′ ...	143° 9′ ...	770 „

TEMPERATURE.

Mean Monthly and Annual Temperature for the various Meteorological Stations in Victoria.

Stations.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
	°	°	°	°	°	°	°	°	°	°	°	°	°
Melbourne	66·6	65·6	63·8	59 0	53·3	49·5	47·8	50·2	53·2	57·0	60·9	63·7	57·5
Portland	67·0	67·2	66·4	63·0	58·4	55·3	53·6	55·5	57·6	60·6	62·4	64·1	60.9
Cape Otway ..	60·4	60·8	59·8	57·4	54·2	51·4	49·2	50·7	50·7	53·0	56·1	58·0	55·1
Port Albert ..	65·3	63·4	62·4	56·5	52·7	48·9	47·0	50·0	53·8	55·3	60·8	60·2	56·4
Gabo Island ..	64·3	65·0	64·4	61·9	57·0	53·5	51·2	52·4	54·6	57·1	59·5	62·2	58·6
Ararat	70·7	67·9	65·7	57·6	51·6	47·1	46·4	49·1	51·1	57·4	63·2	67·6	58·0
Ballarat	63·7	62·7	60·9	54·7	49·0	45·4	42·5	45·8	47·7	52·7	57·7	60·8	53·6
Sandhurst ..	70·7	70·0	66·8	59·7	53·9	48·1	45·6	48·7	51·8	57·7	64·4	67·5	58·7
Beechworth ..	70·4	69·5	68·0	58·3	49·0	46·1	40·8	45·4	47·2	58·9	65·6	67·0	57·2
Stawell	70·1	68·5	64·7	57·3	52·0	48·3	45·3	48·5	51·0	57·2	62·6	66·7	57·7
Berwick	64·9	65·0	63·4	58·9	54·1	51·5	48·6	50·9	51·7	54·8	59·5	62·3	57·1
Daylesford ..	58·4	61·7	63·1	52·6	50·3	44·2	42·2	45·3	48·1	52·1	58·6	60·4	53·1
Heathcote ..	70·4	67·6	66·0	57·4	50·5	45·2	44·4	47·8	51·2	57·9	63·4	67·7	57·4
Castlemaine ..	67·9	65 2	64·8	55·9	50·1	45·8	43·2	47·2	50·2	56·0	61·5	66·5	56·2
Camperdown ..	63·2	62·1	61·0	54·6	49·9	46·9	45·7	47·5	49·1	54·4	59·4	61·7	54·6

Showing the Maxima, Minima, and Range in Temperature of Air at the following Stations during a period of Fourteen Years (1858–1871).

Months.	Melbourne.				Portland.				Sandhurst.				Ballarat.			
	Maxima.	Minima.	Greatest Monthly Range.	Mean Monthly Range.	Maxima.	Minima.	Greatest Monthly Range.	Mean Monthly Range.	Maxima.	Minima.	Greatest Monthly Range.	Mean Monthly Range.	Maxima.	Minima.	Greatest Monthly Range.	Mean Monthly Range.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
January	111·2	44·0	67·2	55·4	103·0	42·0	66·0	50·1	117·4	41·5	75·9	57·2	109·0	37·3	71·7	58·4
February	109·0	40·3	68·7	53·3	104·0	39·0	65·0	50·4	105 0	45·0	60·0	52·4	100·1	36·2	63·9	56·5
March	101·6	41·8	62·8	48·9	100·0	41·0	59·0	47·8	101·5	42·0	59·5	47·7	98·0	34·0	64·0	51·4
April	94·0	35·1	58·9	45·0	86·0	36·0	50·0	39·7	93·0	39·0	54·0	42·9	89·1	31·2	57·9	45·1
May	82·1	31·8	50·3	35·2	78·0	31·0	47·0	34·9	78·5	35·0	43·5	35·7	75·4	30·5	44·9	35·4
June	68·1	28·0	40·1	30·9	70·0	27·0	43·0	32·3	71·5	31·0	40·5	31·0	66·4	27·2	39·2	30·1
July	65·7	27·0	38·7	31·1	68·0	30·0	38·0	30·6	63·0	27·5	35·5	30·0	61·0	22·0	39·0	29·3
August	74·0	28·3	45·7	34·9	78·0	30·0	48·0	34·9	73·0	31·0	42·0	34·4	72·2	26·5	45·7	34·4
September ..	79·0	33·0	46·0	40·3	79·0	30·0	49·0	37·8	80·7	32·0	48·7	39·2	82·4	28·4	54·0	39·4
October	95·8	32·1	63·7	46·9	95·0	35·0	60·0	45·0	95·0	34·0	61·0	48·1	91·3	31·5	59·8	47·6
November ..	103·2	38·8	64·4	52·0	100·0	37·0	63·0	46·6	100·5	37·0	63·5	54·5	99·7	33·0	66·7	55·9
December ..	110·0	40·0	70·0	54·9	104·0	37·0	67·0	51·8	110·5	41·0	69·5	57·7	108·3	31·2	77·1	58·5
Greatest range during the period ..	84·2	..	..	..	81·0	..	..	..	89·9	..	..	..	87·0			
Average yearly range ..	76·0	..	..	..	69·5	..	..	..	76·3	..	..	..	75·9			

Temperature of Soil at Melbourne.

Months.	Mean Temperature of Surface Soil during a period of 14 years (1858-1871).	Ground Thermometers at the following Depths during a period of Eleven Years (1861-1871).											
		14 Inches Deep.			3 Feet Deep.			6 Feet Deep.			8 Feet Deep.		
		Mean Temperat.	Mean Range.	Greatest Range.	Mean Temperat.	Mean Range.	Greatest Range.	Mean Temperat.	Mean Range.	Greatest Range.	Mean Temperat.	Mean Range.	Greatest Range.
	°	°	°	°	°	°	°	°	°	°	°	°	°
January	78·7	64·9	8·1	23·1	68·3	3·8	14·1	66·6	2·9	8·2	63·9	2·6	6·1
February	76·7	64·4	7·1	22·1	68·9	3·1	9·1	68·1	1·2	7·1	65·6	1·2	5·6
March	70·3	64·4	7·8	27·2	67·8	3·5	9·4	67·9	1·6	7·1	66·2	0·8	5·5
April	61·6	58·2	8·4	24·7	64·1	5·1	10·6	65·6	3·2	8·8	65·0	1·9	6·6
May	53·7	52·0	7·3	18·1	58·6	6·1	11·4	61·6	3·9	9·6	62·3	2·9	5·9
June	49·2	47·8	5·0	15·4	53·4	4·0	11·5	57·2	3·6	10·4	59·1	3·1	8·0
July	47·6	45·7	4·3	16·2	50·6	3·2	7·6	54·6	2·5	8·0	56·3	2·6	7·8
August	50·8	46·2	5·6	17·4	50·4	3·1	7·7	53·3	1·2	6·3	54·4	1·4	7·5
September ..	55·4	49·4	5·8	20·3	53·3	4·3	8·0	54·6	2·0	5·3	54·8	0·9	4·2
October	61·8	53·8	8·5	26·1	57·0	5·6	10·8	56·9	3·1	6·7	56·2	2·1	4·3
November ..	68·8	58·4	7·7	27·2	61·5	4·9	12·4	60·4	3·3	7·3	58·7	2·4	4·7
December ..	73·7	62·3	8·5	28·7	65·0	4·3	8·6	63·6	3·1	6·5	61·2	2·5	5·0
Mean for the year ..	62·4	55·6	7·0	..	59·9	4·3	..	60·9	2·6	..	60·3	2·0	
Mean yearly range	..	..	29·5	..	..	22·4	..	..	16·0	..	..	12·9	
Greatest range during the period ..	..	..	..	45·9	..	..	29·0	..	..	22·9	..	..	20·4

Temperature of Solar and Terrestrial Radiation at Melbourne during a period of Thirteen Years (1859–1871).

Months.	Radiation.		—	
	Highest Solar.	Lowest Terrestrial.	Greatest Difference.	Means of Greatest Differences.
	°	°	°	°
January	160·0	37·0	123·0	101·8
February	149·0	36·0	113·0	98·7
March	146·0	35·0	111·0	96·3
April	151·7	29·4	122·3	91·3
May	142·6	27·2	115·4	81·5
June	107·5	25·0	82·5	72·1
July	102·2	22·0	80·2	73·2
August	114·8	24·0	90·8	78·7
September ...	120·2	28·0	92·2	85·6
October	135·8	25·9	109·9	94·7
November	141·1	32·0	109·0	96·9
December	151·8	35·0	116·8	102·5

Greatest difference during the above period ... ... 138·0

From these tables the following facts may be derived:—The mean annual temperature of Melbourne is 57°·6, which approximately represents that of the colony generally, namely, 56°·8. The highest mean occurs at Portland, Gabo Island, and Sandhurst (the two former being coast stations), while the lowest occurs at Daylesford and Ballarat. There can be little doubt that the high means at Portland and Gabo Island are caused by the neighborhood of warm ocean currents, for although the annual mean temperature of most stations on the coast are high, these, and more especially Portland, appear above the average, while at Sandhurst the temperatures range higher during the summer months than at any other inland station. The low mean at Daylesford and Ballarat is also due to the altitude of the stations on the dividing range, the former being 2090, and the latter 1438 feet above the sea.

The annual mean temperature which obtains at Melbourne places it within the same isotherms in the Southern Hemisphere as Lisbon, Madrid, Marseilles, Florence, &c., in the Northern Hemisphere. The ranges of temperature between summer and winter months, however, appear to be much less than at most of these places, and a more equable temperature may be assumed to exist in Melbourne than at similar isotherms in the south of Europe. As regards the extremes and range of temperature at the various localities, Table II. informs us that the highest temperatures in the shade occur at Sandhurst in January, namely 117°, while Melbourne reaches 111°. There are, however, localities in which even higher temperatures rule in the same month, especially on the plains north of the Dividing Range and along the banks of the Murray, between latitudes 34° and 36° 30′, in which localities the temperature has often been as high as 123° to 125° for several days together. It is during the hot winds to which this climate is subject in summer that our highest temperatures occur, but they seldom last many hours, and are usually rapidly followed by a change in direction of the wind, and by a comparatively low thermometer, when a fall of 20° to 25° often occurs in as many minutes.

The minimum temperatures occur in June, July, and August, the lowest yet known in Melbourne being 27°, or 5° below freezing point; at Portland, 27°; at Sandhurst, 27°·5; and at Ballarat 22°, or 10° below freezing.

Table IV. exhibits the results of observations on terrestrial and solar radiation obtained in Melbourne, the only station at which they have been systematically made. The observations of solar radiation are made with a thermometer whose bulb is made of black glass, and also covered with a coating of very fine lamp-black; the thermometer is

enclosed in an outer exhausted and hermetically-sealed glass tube. From the results of a series of experiments with black-bulb thermometers, it appears that at high temperatures, such as are reached in this colony, no two black-bulb thermometers agree; even when obtained from the best makers, a difference of as much as 10° or 12° is often seen between thermometers, which will register alike in ordinary temperatures, when exposed to the sun's rays at a temperature of 130° to 140°.

The temperature of the soil has been obtained at Melbourne only. The results are given in Table III., from whence it will be found that the greatest yearly ranges for the several depths are—for 14 inches, 45°·9; three feet, 29°; six feet, 22°·9; and eight feet, 20°·4; while the mean temperatures in the same order are 59°·5, 59°·5, 60°·3, and 59°·9.

The following table or Thermic Wind-rose will show the mean temperatures for the various directions of the wind in winter and summer:—

	Winter.	Summer.
	°	°
S.	49·40	68·93
S.E.	47·63	61·27
E.	50·10	65·02
N.E.	43· 0	68·09
N.	50·37	75·26
N.W.	47·38	62·67
W....	49·09	58·85
S.W.	50·07	63·34

HUMIDITY.

Mean Relative Humidity for Different Stations.

Stations.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Mean Annual Humidity.
Melbourne ..	0·64	0·66	0·67	0·73	0·78	0·81	0·81	0·76	0·72	0·71	0·66	0·65	0·72
Portland	0 77	0·78	0·78	0·79	0·83	0·83	0·83	0·82	0·79	0·77	0·81	0·77	0·80
Cape Otway ..	0·86	0·84	0·84	0·84	0·84	0·85	0·85	0·83	0·86	0·88	0·84	0·85	0·85
Port Albert ..	0·73	0·75	0·75	0·80	0·79	0·82	0·84	0·83	0·79	0·81	0·78	0·80	0·79
Gabo Island ..	0·87	0·88	0·89	0·89	0·90	0·89	0·89	0·88	0·89	0·88	0·88	0·88	0·88
Ballarat	0·67	0·64	0·66	0·76	0·82	0·89	0·87	0·80	0·80	0·73	0·67	0·65	0·75
Sandhurst ..	0·51	0·52	0·57	0·71	0·75	0·82	0·81	0·75	0·72	0·67	0·55	0·52	0·66
Beechworth ..	0·63	0·50	0·54	0·60	0·75	0·74	0·80	0·75	0·72	0·61	0·55	0·55	0·65

The mean temperature of the dew-point at Melbourne for each month has been found to be :—

	°		°		°		°
September	43·9	December	50·7	March	51·6	June	43·8
October	46·7	January	52·9	April	49·6	July	41·7
November	48·5	February	52·9	May	46·1	August	42·2
Spring	46·4	Summer	52·2	Autumn	49·1	Winter	42·6

Giving a mean annual temperature of the dew-point of 47°·6. The humidity of the air is subject to very great and rapid variations, especially during the summer months, when it is not at all unusual that it is reduced from 60 to 24 per cent. in a few hours ; and frequently during the occurrence of hot winds, with a daily mean of 30 or 40 per cent., it has been reduced as low as 13 or 15 per cent. In such cases of minimum humidity, however, the daily mean or even an excessive humidity immediately follows the change of wind.

PRESSURE OF AIR.

The mean pressure of air in Melbourne from discussion of fourteen years' observation appears to be 29·931 inches ; this, reduced to the sea level, becomes 30·022 inches. Tables VI. and VII., appended, give the mean monthly and annual pressure, and monthly and annual range for the several meteorological stations in the colony.

Mean Pressure of Air at Different Stations.

Stations.	Height above sea-level in ft.	January.	February.	March.	April.	May.	June.	July.	August	September.	October.	November.	December.	Yearly Mean.
Melbourne ..	91	29·823	29·872	29·977	30·026	30·010	30·013	29·998	29·994	29·908	29·876	29·876	29·811	29·931
Portland ..	37	29·898	29·940	30·030	30·071	30·039	30·050	30·037	30·023	29·939	29·922	29·936	29·868	29·979
Cape Otway..	270	29·659	29·692	29·791	29·828	29·781	29·796	29·733	29·758	29·679	29·666	29·677	29·634	29·725
Port Albert..	10	29·883	29·957	30·018	30·092	30·088	30·069	30·091	30·022	29·928	29·965	29·928	29·883	29·996
Gabo Island	40	29·795	29·851	29·917	29·998	29·999	29·950	29·971	29·952	29·869	29·821	29·818	29·797	29·897
Ararat ..	1050	28·765	28·811	28·900	28·918	28·950	28·937	28·895	28·896	28·834	28·801	28·781	28·749	28·856
Ballarat ..	1438	28·415	28·477	28·574	28·617	28·582	28·574	28·558	28·561	28·489	28·469	28·466	28·418	28·519
Sandhurst ..	758	29·093	29·136	29·249	29·308	29·300	29·293	29·277	29·286	29·195	29·137	29·147	29·081	29·209
Beechworth..	1783	28·085	28·081	28·174	28·250	28·146	28·281	28·191	28·066	28·054	28·173	28·102	28·019	28·135

Mean Monthly Range in Pressure of Air at Different Stations.

Stations.	Height above sea level	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Mean monthly range per year
Melbourne ..	91	0·754	0·786	0·703	0·810	0·912	0·960	0·966	1·022	1·025	0·958	0·814	0·896	0·884
Portland ..	37	0·729	0·750	0·676	0·825	1·055	0·999	0·919	1·016	1·058	0·948	0·798	0·993	0·896
Cape Otway..	270	0·849	0·698	0·700	0·765	0·984	1·068	1·138	1·060	1·094	0·954	0·782	0·876	0·914
Port Albert..	10	0·729	0·781	0·836	0·786	0·932	0·959	0·775	1·012	0·893	0·872	0·806	0·967	0·862
Gabo Island	40	0·821	0·820	0·718	0·799	0·832	0·869	0·975	0 937	0·881	1·045	0·825	0·662	0·849
Ararat ..	1050	0·667	0·532	0·601	0·614	0·829	0·825	0·870	0·889	0·901	0·794	0·695	0·753	0·748
Ballarat ..	1438	0·635	0·637	0·546	0·721	0·907	0·855	0·811	0·876	0·892	0·805	0·652	0·813	0·762
Sandhurst ..	751	0·705	0·616	0·560	0·670	0·835	0·878	0·830	0·896	0·962	0·831	0·701	0·806	0·774
Beechworth	1783	0·488	0·618	0·619	0·590	0·815	0·722	0·648	0·895	0·784	0·783	0·552	1·177	0·724

The barometer is subject to very considerable oscillations, and sometimes in very short periods—the greatest occurring during storms from the W., S.W., and S.S.W. The greatest range yet observed, amounting to 1·719 inches, took place in 1863; the maximum, 30·587, occurring in September, and the minimum, 28·868, in December in the same year, during a violent storm from the west. The pressure, as influenced by the direction of wind, will be seen by the following table of mean pressures observed at Melbourne during winds from the various points of the compass :—

	Inches.		Inches.
S.	29·930	N.	29·821
S.E.	29·954	N.W.	29·840
E.	29·896	W.	29·854
N.E.	29·878	S.W.	29·885

The mean daily range in pressure of air for Melbourne, 120 feet, and for Ballarat, 1437 feet, above the level of the sea, is given in the table below :—

	Melbourne. Inches.		Ballarat. Inches.
Spring	0·191	... ...	0·104
Summer	0·163	... ...	0·088
Autumn	0·157	... ...	0·092
Winter	0·152	... ...	0·098
Year	0·166	... ...	0·096

The mean daily range is greatest for Melbourne in September, and least in February, from which Ballarat seems to differ, in so far as there the greatest range occurs in August, the differences for these months being 0·056 and 0·032 inches respectively.

As a rule, the greatest pressure occurs with the wind from S. to S.E., and the lowest from N. to W. From discussion of many years' observation, there appears to be a maximum of mean pressure in the early part of August.

RAINFALL.

Although Victoria has generally been considered a dry climate, we find that the rainfall usually attains to the average of similar latitudes in other parts of the world; but it is doubtless to the large amount of spontaneous evaporation, as well as perhaps to the immense tracts of unbroken surface soil, that the frequent inadequacy of our rainfall is due. In some localities, however, not only does the fall of rain reach a larger average, but, owing to sheltered and most frequently submontane positions, the evaporation is almost reduced to a minimum. This is particularly the case in the valleys and gullies at the foot of our mountain ranges, where the character of the vegetation is considerably modified thereby.

From observations of the rainfall carried on since 1840, but unfortunately with a break in the years 1851, '52, '53, and '54, we may assume the annual average to be 25·66. From Professor Neumayer's observations of spontaneous evaporation it appears that it amounts to 42 inches per annum, and occurs principally during the spring and summer months; in winter and autumn the rainfall generally exceeds the evaporation by a considerable amount. It would thus appear that spontaneous evaporation exceeds the rainfall by 16·4 inches. The conditions that generally affect spontaneous evaporation can scarcely be brought to bear upon any of the methods of observation usually adopted, and determinations made from a small surface of water in an open position will, doubtless, give a result in excess of the average evaporation, and such, I think, we may assume to be the case in this instance; nevertheless, spontaneous evaporation in most parts of Victoria is greatly in excess of the rainfall.

In the tables appended, the annual rainfall in Melbourne, and other localities in which reliable observations have been made, is given for each year, as well as the number of days' rain and amount of rainfall for every month and each year in Melbourne from 1858 to 1865.

Yearly Rainfall at Different Stations.

Years.	Melbourne.	Bunyong.	Ballarat.	Portland.	Camperdown.	Heathcote.	Beechworth.	Echuca.	Gabo Island.	Longerenong, Wimmera.	Sandhurst.	Ararat.	Cape Otway.	Werrankmbeal.	Stawell.	Berwick.	Dayleford.	Warrnambool.	Kew.	Mornington.	Kattandra.	Wahgunyah.	Hamilton.	Geelong.	Sale.	Amherst.
1840	22·57	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1841	30·18	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1842	31·16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1843	21·54	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1844	28·26	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1845	23·93	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1846	30·53	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1847	30·18	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1848	33·15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1849	44·25	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1850	26·93	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1851	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1852	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1853	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1854	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1855	28·21	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1856	29·75	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1857	23·90	25·39	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1858	26·02	26·11	24·47	27·30	27·97	23·79	30·87	15·76	39·82	17·26	18·50	23·35	—	—	18·57	—	—	—	—	—	—	—	19·97	—	—	17·66
1859	21·80	—	23·72	31·42	27·60	21·85	—	19·13	38·74	20·17	33·92	37·37	49·66	21·45	25·41	38·36	31·74	27·53	27·95	26·53	20·02	20·20	31·15	20·04	28·61	35·26
1860	25·40	25·49	23·80	26·31	29·97	29·01	29·70	—	—	—	23·03	15·71	38·62	8·81	17·55	29·81	—	26·84	35·80	45·92	37·13	43·90	25·26	27·23	22·76	25·61
1861	29·15	30·67	23·66	39·58	36·94	28·73	26·94	—	40·12	33·08	33·92	—	34·29	6·17	15·28	34·33	—	—	33·76	30·81	—	27·10	29·33	20·72	33·95	33·63
1862	22·08	26·79	23·50	31·01	26·15	16·99	—	—	—	—	23·03	18·21	34·29	14·17	29·30	46·38	50·70	—	30·65	43·01	—	26·29	24·63	—	—	25·91
1863	36·43	43·61	37·22	45·31	—	—	—	—	—	—	10·85	25·23	33·98	—	23·20	42·39	40·36	—	27·24	29·93	—	24·22	—	—	—	—
1864	27·40	25·75	24·02	33·06	—	—	—	—	—	—	21·41	23·27	31·99	—	29·95	51·40	42·50	—	—	—	—	—	—	—	—	—
1865	15·94	25·01	20·09	34·37	—	—	—	—	—	—	26·66	20·63	36·84	—	23·44	39·33	33·08	—	—	—	—	—	—	—	—	—
1866	22·41	28·63	23·35	31·75	—	—	—	—	—	—	17·34	28·20	33·60	—	—	—	—	—	—	—	—	—	—	—	—	—
1867	25·79	31·89	29·87	33·87	—	—	—	—	26·23	—	21·29	25·75	36·66	—	—	—	—	—	—	—	—	—	—	—	—	—
1868	18·27	22·74	17·23	30·32	—	—	—	—	42·80	—	38·37	28·79	37·60	—	—	—	—	—	—	—	—	—	—	—	—	—
1869	24·59	23·31	22·85	23·53	—	—	—	—	—	—	27·12	21·45	32·11	—	—	—	—	—	—	—	—	—	—	—	—	—
1870	33·75	41·72	36·38	—	—	—	—	—	41·22	—	26·25	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1871	30·17	29·07	27·51	37·01	28·14	—	—	—	36·86	—	20·54	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1872	32·32	36·14	31·81	30·77	34·12	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1873	25·61	31·32	27·49	—	27·75	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

SHOWING THE AMOUNT OF RAINFALL AND THE NUMBER OF DAYS OF RAIN FOR EVERY MONTH AND FOR EACH YEAR, TOGETHER WITH THE AVERAGE AMOUNT AND AVERAGE NUMBER OF DAYS OF RAIN FOR EVERY MONTH, FOR THE PERIOD OF 14 YEARS (1858–1871).

Years.	January.		February.		March.		April.		May.		June.		July.		August.		September.		October.		November.		December.		For the whole year.	
	Amount.	No. of Days.	Amount.	No. of Days.	Amount.	No. of Days.	Amount.	No. of Days.	Amount.	No. of Days.	Amount.	No. of Days.	Amount.	No. of Days.	Amount.	No. of Days.	Amount.	No. of Days.	Amount.	No. of Days.	Amount.	No. of Days.	Amount.	No. of Days.	Amount.	No. of Days.
1858	0·83	9	4·91	12	1·09	9	0·60	11	1·38	15	0·76	13	2·07	18	1·62	16	2·17	22	0·87	10	3·19	11	6·47	12	26·01	158
1859	2·86	13	0·83	10	0·18	8	1·29	8	2·32	14	4·51	21	1·04	13	0·95	17	2·77	16	2·33	13	1·71	12	1·03	11	21·82	156
1860	1·97	10	1·08	4	0·96	6	4·53	12	0·99	11	1·72	16	1·21	9	0·79	10	2·72	17	1·97	15	2·38	12	5·06	11	25·38	133
1861	2·25	14	4·62	13	2·65	9	1·29	11	0·84	12	1·78	16	2·14	16	1·47	14	3·19	17	4·89	14	1·46	11	2·58	12	29·16	159
1862	1·25	4	0·19	3	1·08	8	3·56	14	4·31	19	2·99	16	2·26	20	1·95	14	0·98	14	2·03	11	0·32	9	1·16	7	22·03	139
1863	1·84	9	2·74	12	3·84	14	1·76	10	2·54	16	1·16	10	2·87	16	2·10	18	1·99	15	4·89	18	3·51	13	7·18	14	36·42	165
1864	2·07	7	2·63	9	1·80	7	4·53	18	1·02	9	0·81	10	2·83	13	2·50	18	2·28	14	4·08	18	0·64	9	2·21	12	27·40	144
1865	0·16	3	0·59	8	1·26	8	0·72	7	3·41	18	1·64	10	2·05	14	1·22	14	1·87	13	0·78	8	0·89	7	1·35	9	15·94	119
1866	1·43	4	0·35	5	2·14	6	0·57	5	2·92	7	1·64	11	2·04	11	2·26	15	2·08	14	3·25	15	2·17	10	1·56	4	22·41	107
1867	1·92	6	2·68	7	0·75	8	2·42	11	2·38	12	1·03	7	1·66	20	1·91	14	3·43	18	3·35	18	0·87	3	3·34	9	25·79	133
1868	2·11	10	0·99	6	1·02	5	1·44	10	1·48	8	1·21	11	1·46	15	1·01	10	2·13	15	1·05	11	3·19	11	1·18	8	18·27	120
1869	1·46	6	0·89	10	1·53	3	1·27	7	1·99	14	2·37	13	1·13	13	1·65	10	1·58	13	7·61	20	2·12	13	0·98	7	24·58	129
1870	3·15	4	0·03	1	0·34	3	4·88	15	2·78	10	3·32	21	3·16	14	2·14	15	5·87	17	4·38	12	3·23	13	0·49	4	33·77	129
1871	3·00	9	3·23	6	2·37	9	1·29	6	1·39	11	1·25	9	2·08	15	3·58	11	1·86	15	2·88	11	4·19	16	3·05	7	30·17	125
Average	1·83	7·7	1·84	7·6	1·50	7·3	2·15	10·4	2·13	12·6	1·87	13·1	2·00	14·8	1·80	14·0	2·49	15·7	3·17	13·9	2·13	10·7	2·69	9·1	25·66	137

By selecting Melbourne as the locality in which the most extended series of observations have been obtained, we remark that in the years 1848, 1849, and in 1863, the rainfall was far above the average; in 1864, 1865, 1866, and 1870, it fell below the average, especially 1865, when it only reached 15·9 inches. In 1848 and 1849 extensive and destructive floods occurred, and again in 1863; in 1865 and 1866 the country suffered from a severe drought; and the year 1851, following the heavy rains of 1849, was also a dry one, although the amount of rainfall, if ever observed, cannot yet be ascertained. An opinion has often been expressed that there is a periodicity in the excessive rainfalls and droughts in Australia generally; but although the above results may give some slight grounds for this supposition, a far greater number of years' observations will be necessary from which to deduce any law of this kind.

YEARLY AVERAGE TABLE.

AVERAGES AND EXTREMES FOR THE FOUR SEASONS AND FOR THE YEAR OF DIFFERENT METEOROLOGICAL ELEMENTS AT MELBOURNE OBSERVATORY.

(91 FEET ABOVE SEA-LEVEL.)

Mean of Barometer for Spring (Sept.–Nov.) ..	29·887 inches.	Mean monthly range,	0·812 inches.	
" Summer (Dec.–Feb.) ..	29·835 "	"	0·810 "	
" Autumn (Mar.–May) ..	30·004 "	"	0·983 "	
" Winter (June–Aug.) ..	30·002 "	"	0·932 "	
" Year	29·932 "	"	0·884 "	
Greatest Monthly range	1·503 "	in August 1870.		
Smallest	0·525 "	in March 1870.		
Greatest Yearly range	1·719 "	in 1863.		
Smallest	1·218 "	in 1860.		
Greatest range during 14 years	1·810 "			

	°		°
Mean Temperature of Air for Spring	57·0	Mean Monthly range ..	46·4
" " Summer ..	65·3	" ..	54·5
" " Autumn ..	58·7	" ..	43·0
" " Winter ..	49·2	" ..	32·3
" " Year	57·6	" ..	44·1
Greatest Monthly range	69·1	in December 1868.	
Smallest "	22·9	in August 1861.	
Greatest Yearly range	82·6	in 1868.	
Greatest range during 14 years	84·2		
Mean Daily range for Spring	19·8		
" Summer	22·1		
" Autumn	18·6		
" Winter	14·8		
" Year	18·8		
Greatest Mean Daily range in 14 years ..	27·2	in November 1862.	
Smallest " " "	7·7	in June 1860.	
Highest Temperature in the Shade	111·2	on 14th January 1862, and 111·0° on 22nd January 1860.	
Lowest " "	27·0	on 21st July 1869, and 27·4° on 11th July 1868.	
Highest Solar Radiation	160·0	on 14th January 1862.	
Lowest Terrestrial Radiation	22·0	on 21st July 1869.	

During 14 years.

Mean Temperature of Surface-soil for	Spring ..	62·0	Year, 62·4°. During 14 years.
„ „	Summer..	76·5	
„ „	Autumn..	61·9	
„ „	Winter ..	49·2	
„ of Bulb 14 in. deep for	Spring ..	53·9	Year, 56·0°. Average for 12 years.
„ „	Summer..	65·2	
„ „	Autumn..	58·2	
„ „	Winter ..	46·6	
„ of Bulb 3 feet deep for	Spring ..	57·3	Year, 60·0°. Average for 11 years.
„ „	Summer..	67·6	
„ „	Autumn..	63·5	
„ „	Winter ..	51·5	
„ of Bulb 6 feet deep for	Spring ..	57·3	Year, 60·9°. Average for 11 years.
„ „	Summer..	66·3	
„ „	Autumn..	65·0	
„ „	Winter ..	55·0	
„ of Bulb 8 feet deep for	Spring ..	56·6	Year, 60·4°. Average for 11 years.
„ „	Summer..	63·7	
„ „	Autumn..	64 5	
„ „	Winter ..	56·6	
„ of Dew-point for	Spring ..	46·4	Year, 47·6°. Average for 13 years.
„ „	Summer..	52·2	
„ „	Autumn..	49·1	
„ „	Winter ..	42·6	

Mean Humidity for Spring, 70 per cent. Summer, 65 per cent. } Year, 72 per cent. Average for 14 Years.
„ Autumn, 73 „ Winter, 79 „ }

Mean Rainfall for Spring, 7·79 in. in 40·3 days. Summer, 6·41 in. in 24·4 days. } Average for 14 years.
„ Autumn, 5·78 in. in 28·9 days. Winter, 5·67 in. in 41·9 days. }
„ Year, 25·65 in. in 135·5 days.

Greatest Yearly Rainfall, 44·25 in. in 1849 } Since 1840.
Smallest „ 15·94 in. in 1869 }

WIND:—

Mean number of Miles for the Year 7838 } Average of 6 years.
Mean hourly velocity, 10·7 miles }

Greatest hourly velocity, 58 miles, from midnight to 1 a.m. on 8th March 1866, from west.

Percentage of hours during which the Wind blew from different Points of the Compass. (Average of 6 years):—

	N.	N.W.	W.	S.W.	S.	S.E.	E.	N.E.	CALMS.
Spring	16·2	8·6	15·9	17·0	16·1	8·9	4·3	12·0	1·0
Summer ..	7·4	4·0	8·6	19·3	24·9	20·2	6·2	8·5	0·9
Autumn ..	14·4	6·2	10·4	13·3	16·0	16·7	6·7	14·9	1·4
Winter ..	31·8	13·5	13·9	8·7	5·3	4·8	3·3	17·7	1·0
Year	17·5	8·1	12·2	14·5	15·6	12·6	5·1	13·3	1·1

Although a moderately precise conception of the climate of this colony may be obtained from the foregoing remarks, there will yet remain much that modifies a climate, even to a large extent, which cannot be expressed in tables, or directly deduced from discussion of the various meteorological elements. A brief description, therefore, of a cycle of the seasons will, in connexion with the tables already given, enable the reader to form a moderately correct idea of the climate of Victoria.

The spring season, which may be said to include September, October, and November, generally sets in about the beginning of September;

during which month, although slight frosts sometimes occur, the weather is usually mild, and often quite warm. Rather above the monthly average of rain also frequently falls. Strong northerly and westerly winds are prevalent in September and October, but the currents of air, both as regards frequency and velocity, seem to be more equally distributed during these months than at other parts of the year. The northerly winds begin to assume the dry and warm condition which characterizes them throughout the summer months, and it is not at all unfrequent that quite a hot wind may prevail for a short period even in October; the weather generally, however, in September and October, is genial and pleasant. November, also representing the height of spring, is usually characterized by fine, warm, and sometimes even hot weather. It is not at all unusual to get a large rainfall in October or November, sometimes giving rise to extensive floods; in some seasons, however, the rainfall after the commencement of October diminishes considerably, and frequent dry, and even hot, northerly winds in November parch the grass and other herbage, giving to the plains and hills a sand-like appearance; but in others the pastures remain green till January, and in many parts of the colony throughout the year.

The summer season includes the months of December, January, and February. December is often marked by very changeable weather, and although generally hot and dry, it is not unfrequently broken up by cold and stormy intervals, with heavy rains and gales of wind. The northerly winds become more or less hot according to the amount and distribution of the rainfall throughout the interior during spring. Very great changes of temperature often take place in a few hours; for instance, a warm north wind prevails in the morning, with a temperature reaching as high as 90° to 100°; a lull in the afternoon is quickly followed by a strong breeze from the S.W., and the temperature becomes reduced to 65° or 60° in fifteen or twenty minutes.

The highest mean temperature occurs in January; February also is often characterized by great heat and dryness. It is during these months that the northerly winds become perfect siroccos for short periods, and if the spring has been dry, extensive bush-fires occur on the plains and in the forests, giving rise to a considerable increase of temperature, and superadding to the already unpleasant state of things a smoky and lurid atmosphere over considerable areas in the vicinity. Although unpleasantly hot weather very frequently intervenes throughout the summer months, yet a large and often the largest portion of the weather is fine and pleasant, with cool southerly or south-westerly winds.

The autumn season, including the months of March, April, and May, although subject to stormy weather, gales of wind, and large rainfall—especially in its earlier part, and following the equinoxes—may nevertheless be called the most genial and beautiful portions of the year. It constitutes a second spring, for so soon as vegetation receives the moisture it has thirsted for through the summer, the indigenous plants and trees put forth a growth that often exceeds that of spring. The temperature on the whole maintains a moderate mean ; the northerly winds now become cooler, and solar radiation is considerably reduced ; heavy dews fall at night, and sometimes towards the end of this season fog occurs during the night and early morning in very calm weather. In April the mean temperature becomes 59°, and in May 53°.

Winter includes June, July, and August. This season, though usually marked by frequent rain and strong winds, especially from the north, is in some years remarkably dry, with a small rainfall ; the temperature does not reach its minimum till the middle of July and the beginning of August, and seldom in Melbourne falls much below freezing point. Ice and hoar-frost occur generally only on a very few occasions during the winter in the neighborhood of Melbourne, the former sometimes attaining a quarter of an inch in thickness. At higher levels, however, frost and ice have been observed as early as May, and forms much more frequently during the winter months than at the lower levels ; the highest mountain summits too are in most seasons seen to be clothed in snow by June, and sometimes even as early as the beginning of May. The strongest winds in winter are usually from the north, from which quarter it often blows with great violence ; wind from this direction is dry, and usually very cold at this season.

The worst vicissitudes to which the climate of Victoria is subject, in common with Australia generally, is the occasional droughts ; these, as already stated, appear to follow those years characterized by unusual rainfall ; a fact that has given rise to a conjecture that both the excessively wet and the excessively dry seasons are periodical. The last drought to which the colony was subject extended from the summer of 1865 till almost the winter of 1866, and was doubtless due to the small rainfall in the autumn and spring months.

METEOROLOGICAL

Results of Meteorological Observations made at Melbourne

Lat. 37° 49′ 53″ S. Long. 9$^{h.}$ 39$^{m.}$ 54·8$^{s.}$ E.

Day of Month.	Barometer reduced to 32° Fahrenheit.	Mean Temperature.			Self-registering Thermometers.				Humidity.
		Air.	Surface Soil.	Dew-point.	In Shade.		Radiation.		
	Mean.				Max.	Min.	Solar Max.	Terrestrial Min.	Mean.
	inches.	°	°	°	°	°	°	°	Sat. = 1.
1	29·751	64·1	74·3	51·1	72·1	52·0	118·0	47·2	0·63
2	29·858	57·2	69·7	44·0	64·2	54·0	111·0	52·2	0·61
3	29·971	59·8	71·2	48 2	67·0	48·0	117·2	42·0	0·66
4	29·964	65·9	75·4	58·2	75 2	49·3	123·6	44·0	0·76
5	29·824	72·9	83·6	65·2	98·4	60·0	139·0	57·0	0·77
6	29·887	63·6	70·6	58·5	68·6	59·2	118·4	52·0	0 83
7	29·988	60·2	66·3	50·5	70·0	52·0	93·0	48·0	0·70
8	29 990	62·6	69·9	49·6	73·0	51·5	121 8	48 8	0·63
9	29·982	61·7	72·4	50·5	74·0	53·2	124·9	51·0	0·67
10	30·011	65·2	77·2	52·5	75·0	49·5	126·0	44·3	0·64
11	29·917	65·1	75·1	52·9	77·1	50·0	118·8	45·5	0·65
12	29·645	59·0	64·6	55·5	68 7	53·0	121·0	56·5	0·88
13	29·837	58·0	60·7	50·5	67·9	53 6	119·0	55·0	0·76
14	30·092	59·0	65·7	49·8	67·0	53·0	115·8	50·0	0·72
15	30·045	59·8	70·9	52·7	68·3	49·0	114·1	43·2	0·77
16	30·036	56·5	74·8	52·1	67·6	51·5	118·0	46·0	0·77
17	30·060	67·2	78·8	59·0	85·2	50·0	129·2	46·0	0·75
18	30·028	79·7	89·0	57·8	95·0	61·2	133·8	56·8	0·47
19	29·851	77·9	87·4	60·6	94·2	61·0	135·0	56·2	0·55
20	29 687	77·7	89·8	58·9	101·0	60·7	142·3	55·8	0·53
21	29·699	63·3	67·9	53·9	74·1	59·8	119·1	57·0	0·71
22	29·995	61·1	67·4	54·5	67·2	56·0	118·1	54·0	0·79
23	30·068	61·1	74·9	55·4	69·0	52·0	113·9	47·0	0·82
24	30·043	61·8	72·5	55·7	68·8	56·7	100·1	53·9	0·81
25	30·127	65·7	81·4	52·1	80·8	57·5	125·0	56·7	0·62
26	30·192	68·8	79·8	54·9	84·0	51·0	129·0	45·1	0·61
27	30·080	69·8	82·1	60·4	92·0	54·0	134·0	48·0	0·72
28	29·916	76·4	86·0	59·7	93·5	62·4	138·3	58·1	0·56
29	29·768	80·9	86·2	60·7	92·0	69·0	126·2	66·0	0·50
30	29·808	61·6	65·2	57·2	66·0	58·0	87·5	56·0	0 86
31	30·079	56·7	64·9	46·2	67·1	47·1	120·0	42·7	0·68
Means & Sums	29·942	65·3	74·7	54·5	76·9	54·7	121·0	51·0	0·69

GENERAL ABSTRACT :

Barometer :—

Maximum, 30·241 inches, on the 26th.
Minimum, 29·577 inches, on the 12th, and 29·596 inches, on the 20th.
Range in the month, 0·664 inches.
Mean for the month, 29·942 inches, being 0·120 inches higher than the average for the preceding fifteen years, and the highest on record during that period.

Temperature of Air :—

Highest in the shade, 101·0°, on the 20th.
Lowest in the shade, 47·1°, on the 31st.
Range in the month, 53·9°.
Greatest daily range, 40·3°, on the 20th.
Least daily range, 8·0°, on the 30th.
Mean daily range, 22·2°.
Mean for the month, 65·3°, being 1·5 lower than the average for the preceding fifteen years.

Temperature of Soil :—

On Surface—Mean, 74·7°, being 2·8° lower than the average for the preceding fifteen years.

OBSERVATIONS.

Observatory for the Month ending 31st January 1873.

Height above sea-level, 91 feet.

Day of Month.	Wind. — Prevailing Direction.	Amount of Rain.	Remarks.
		inches.	
1	S.	0	Beautiful clear day, cool breeze; overcast in evening.
2	S.E. and S. ..	0	Very fine and cool; lightning in S. at 10 p.m.
3	S.E. and S.W.	0	Delightful cool day.
4	S.W. and W...	0	Very fine and clear; warm in a.m.; cool in p.m.
5	N. and W. ..	0·056	Hot and sultry; at 3 p.m. wind shifted from N. to S.W., blowing strong for a short time; close and sultry and showery in evening.
6	S.	0·144	Dull, with misty rain, in a.m.; fine and cool, but cloudy, in p.m.
7	S.E.	0	Fine, but dull, evening clear.
8	S.E.	0	Fine and cool, but boisterous.
9	S.E.	0	Fine, cool, and pleasant.
10	S.E. and E. ..	0	Fine, clear, and warm.
11	S.E.	0	Fine and pleasant; dull in p.m.
12	S.E.	0·293	Dull and showery all day; squally in p.m.
13	S.	0·146	Dull, cold, and boisterous; showery in early morning.
14	S.E. and S. ..	0	Fine, cool, and pleasant.
15	S.E. and S. ..	0	Heavy dew; very fine, clear, and cool.
16	S.E. and S. ..	0	Heavy dew; fine, but dull, in a.m.; very fine, clear, and cool in p.m.
17	E. and S.E. ..	0	Heavy dew; fine, clear, and warm.
18	N. and E. ..	0	Heavy dew; fine and clear, but hot and sultry.
19	S. and S.E. ..	0	Heavy dew; fine and clear, but very hot and sultry.
20	S.E. and S. ..	0	Heavy dew; very hot and sultry until, at 4.45 p.m., wind went round to S., blowing fresh and cool.
21	W. and S.W...	0·085	Fine and cool, but cloudy, in a.m.; squally and showery in p.m.
22	S. and S.W. ..	0·240	Dull and boisterous, with rain squalls, in a.m.; fine, cool, and pleasant, in p.m.
23	S.E. and S.W.	0	Very fine and pleasant all day.
24	S. and S.E. ..	0	Dull and misty in a.m.; fine and pleasant, but cloudy, in p.m.
25	S.E.	0	Overcast in early morning; after that fine, clear, and pleasant.
26	S.E. and E. ..	0	Heavy dew; fine and warm.
27	E. and S.E. ..	0	Heavy dew; fine, but cloudy and sultry.
28	E. and N.E. ..	0	Dull and sultry.
29	N. and N.E. ..	0	Dull and sultry.
30	N. and S. ..	1·104	Heavy rain and squalls after 9 a.m.; thunder at 1 p.m.; squally, but fine in evening.
31	W. and S. ..	0	Fine, cool, and pleasant.
..	..	2·068	

JANUARY 1873.

Temperature of Soil—*continued.*

Bulb 14 inches deep—Maximum, 56·4°; minimum, 47·8°; range in the month, 8·6°; mean, 51·3°.

Bulb 3 feet deep—Maximum, 69·0°; minimum, 64·2°; range in the month, 4·8°; mean, 66·7°, being 1·9° lower than the average for the preceding eleven years.

Bulb 6 feet deep—Maximum, 67·0°; minimum, 64·2°; range in the month, 2·8°; mean, 65·6°, being 1·3° lower than the average for the preceding eleven years.

Bulb 8 feet deep—Maximum, 64·1°; minimum, 62·2°; range in the month, 1·9°; mean, 63·1°, being 1° lower than the average for the preceding eleven years.

Solar Radiation:—

Maximum, 142·3°, on the 20th.

Terrestrial Radiation:—

Minimum, 42·0°, on the 3rd, and 42·7°, on the 31st.

Humidity of Air:—

Mean, 69 (that of Saturation being represented by 100), being 4 higher than the average for the preceding fifteen years.

Temperature of Dew-point:—

Mean, 54·5°, being 1·1° higher than the average for the preceding fourteen years

Results of Meteorological Observations made at Melbourne

Lat. 37° 49′ 53″ S. Long. 9$^{h.}$ 39$^{m.}$ 54·8$^{s.}$ E.

Day of Month.	Barometer reduced to 32° Fahrenheit.	Mean Temperature.			Self-registering Thermometers.				Humidity.
					In Shade.		Radiation.		
	Mean.	Air.	Surface Soil.	Dew-point.	Max.	Min.	Solar Max.	Terrestrial Min.	Mean.
	inches.	°	°	°	°	°	°	°	Sat. = 1.
1	30·110	59·8	73·9	49·4	71·2	49·1	125·3	46·3	0·69
2	30·099	61·1	79·2	53·5	73·4	52·9	126·6	49·0	0·76
3	30·025	70·0	83·3	56·1	90·0	52·9	135·3	48·2	0·61
4	29·911	75·5	86·4	59·0	91·0	61·0	136·0	55·1	0·57
5	29·975	66·0	82·7	57·5	71·0	60·0	116·0	57·0	0·74
6	29·893	68·3	73·2	60·9	99·2	54·0	143·1	49·1	0·77
7	29·952	64·3	68·5	59·4	72·0	61·8	112·0	60·0	0·84
8	29·858	66·8	73·6	58·9	78·0	59·5	126·8	58·9	0·76
9	29·789	64·3	70·5	58·2	71·7	62·0	105·4	59·1	0·80
10	29·924	60·6	72·6	47·9	68·0	54·0	115·0	49·0	0·63
11	30·008	58·9	67·1	49·5	67·0	55·3	109·6	52·9	0·71
12	30·043	62·1	69·7	53·9	68·7	53·3	119·0	52·9	0·75
13	30·090	61·1	74·0	53·1	69·1	56·5	116·9	54·0	0·75
14	29·975	64·3	78·3	57·6	77·0	49·6	126·0	45·0	0·79
15	29·767	78·3	90·7	54·4	96·2	56·2	138·3	52·0	0·44
16	29·684	75·7	82·5	59·3	102·4	64·0	141·8	62·0	0·57
17	29·983	63·9	66·5	59·5	69·0	61·3	81·7	59·7	0·86
18	29·924	65·1	66·2	62·6	74·9	60·3	99·1	57·8	0·91
19	29·787	66·4	70·9	60·4	76·0	60·6	122·0	..	0·81
20	29·866	62·4	64·8	53·4	72·9	53·9	110·9	48·8	0·72
21	29·894	61·0	66·6	54·4	69·7	55·0	123·9	51·2	0·79
22	29·790	61·4	64·1	58·4	70·5	57·0	122·0	54·0	0·90
23	29·674	66·1	69·6	60·2	77·9	58·0	126·8	56·0	0·82
24	29·735	70·2	70·7	62·3	82·9	64·0	130·9	61·5	0·76
25	29·804	69·9	69·9	62·8	78·0	67·1	108·0	65·5	0·78
26	29·764	70·7	73·4	63·5	81·2	65·0	129·0	63·5	0·78
27	29·743	67·6	77·4	63·0	76·8	63·4	123·1	61·3	0·85
28	29·715	69·3	77·2	62·9	85·0	61·2	128·8	60·0	0·80
Means & Sums	29·885	66·1	73·7	57·6	77·9	58·2	121·4	55·2	0·75

GENERAL ABSTRACT :

Barometer :—

Maximum, 30·143 inches, on the 1st.
Minimum, 29·632 inches, on the 23rd ; 29·647 inches, on the 16th ; and 29·653 inches, on the 28th.
Range in the month, 0·511 inches.
Mean for the month, 29·885 inches, being 0·007 inches higher than the average for the preceding fifteen years.

Temperature of Air :—

Highest in the shade, 102·4°, on the 16th.
Lowest in the shade, 49·1°, on the 1st, and 49·6° on the 14th.
Range in the month, 53·3°.
Greatest daily range, 45·2°, on the 6th.
Least daily range, 7·7°, on the 17th.
Mean daily range, 19·7°.
Mean for the month, 66·1°, being 0·6° higher than the average for the preceding fifteen years.

Temperature of Soil :—

On Surface—Mean, 73·7°, being 1·5° lower than the average for the preceding fourteen years.
Bulb 14 inches deep—Maximum, 55·0° ; minimum, 49·3° ; range in the month, 5·7° ; mean, 51·8°.

Observatory for the Month ending 28th February 1873.

Height above Sea-level, 91 feet.

Day of Month.	Wind. — Prevailing Direction.	Amount of Rain.	Remarks.
		inches.	
1	S.E.	0	Fine and pleasant.
2	S.E.	0	Cloudy in a.m.; very fine and clear in p.m.
3	N. and N.E...	0	Heavy dew; very fine and clear, but rather hot.
4	N. and N.E. ..	0	Heavy dew; fine and clear, but hot; dull in evening, with scattered rain.
5	S. and S.W. ..	0·006	Very fine, cool, and pleasant.
6	N.E. and E. ..	1·040	Heavy dew; fine, but hot, in a.m.; thunderstorm with rain and hail at 1 p.m.
7	S.W. and S.E.	0·014	Fine, but dull and overcast.
8	S.E.	0	Fine, but dull and sultry; thunder towards N. in p.m.
9	S.	0·030	Dull and misty in a.m., with distant thunder in N.W.; thunder and lightning and light rain showers in p.m.
10	S.W.	0·004	Fine, with cool fresh breeze.
11	S.W. and W.	0·038	Dull and boisterous, with light rain showers.
12	S W. and S. ..	0·272	Dull, squally, and showery in a.m.; fine in p.m.
13	S.W. and S. ..	0·009	Dull in a.m.; very fine and clear in p.m.
14	S. and S.E. ..	0	Very heavy dew; fine and pleasant; evening clear.
15	N.E. and N. ..	0	Heavy dew; fine, but hot and sultry.
16	N.	0·533	Fine, but very hot and boisterous, in a.m.; dull and close, with thunder in N.E., in p.m.; thunderstorm, with heavy rain showers, at 7 p.m.
17	S.E.	0·084	Dull and showery.
18	E.	1·209	Sultry, with thunder and lightning at intervals, and rain shower; severe thunderstorm during the evening, with heavy rainfall.
19	S.W. and W.	0·162	Fine, but dull and sultry; lightning in E. in evening.
20	S.W. and W.	0	Heavy dew; fine, but dull and rather close.
21	S.W. and W.	0·140	Fine, with occasional light rain showers; lightning in E. in evening.
22	S.E.	0·899	Squally and showery.
23	S.E.	0·035	Fine, but dull; rain showers and distant thunder at 4 p.m.
24	S.E.	0·028	Dull and boisterous; lightning in N. during evening.
25	S.E. and E. ..	0	Dull and sultry.
26	E. and S.E. ..	0·018	Dull and very close and sultry; lightning in N. during evening.
27	S.	0·053	Fine, but sultry; lightning and distant thunder in N.E. and E. in evening.
28	S.	0·093	Very fine in a.m.; hot in p.m.; light rain squalls during evening.
..	..	4·667	

FEBRUARY 1873.

Temperature of Soil—*continued.*

Bulb 3 feet deep—Maximum, 69·1°; minimum, 67·6°; range in the month, 1·5°; mean, 68·3°, being 0·8° lower than the average for the preceding eleven years.

Bulb 6 feet deep—Maximum, 67·6°; minimum, 67·2°; range in the month, 0·4°; mean, 67·4°, being 1·0° lower than the average for the preceding eleven years.

Bulb 8 feet deep—Maximum, 65 0°; minimum, 64·0°; range in the month, 1·0°; mean, 64·7°, being 1·1° lower than the average for the preceding eleven years.

Solar Radiation:—

Maximum, 143·1°, on the 6th, and 141·8°, on the 16th.

Terrestrial Radiation:—

Minimum, 45·0°, on the 14th.

Humidity of Air:—

Mean, 75 (that of Saturation being represented by 100), being 9 higher than the average for the preceding fifteen years, and the highest on record during that period; the next highest having occurred in 1858 and 1861, when it reached 74.

Temperature of Dew-point:—

Mean, 57·6°, being 4·6° higher than the average for the preceding fourteen years, and the highest on record during that period, the next highest, 57·3°, having occurred in February 1871.

Results of Meteorological Observations made at Melbourne

Lat. 37° 49′ 53″ S. Long. 9h. 39m. 54·8s. E.

Day of Month.	Barometer reduced to 32° Fahrenheit.	Mean Temperature.			Self-registering Thermometers.				Humidity.
					In Shade.		Radiation.		
	Mean.	Air.	Surface Soil.	Dew-point.	Max.	Min.	Solar Max.	Terrestrial Min.	Mean.
	inches.	°	°	°	°	°	°	°	Sat. = 1.
1	29·941	60·4	69·0	49·9	69·0	55·0	118·0	50·0	0·68
2	29·879	61·6	68·4	53·9	78·8	50·0	125·0	44·7	0·76
3	29·915	65·7	76·3	60·0	79·0	53·5	121·0	48·7	0·82
4	29·976	67·6	78·3	63·0	76·0	59·0	118·9	54·9	0·85
5	29·775	76·2	85·3	58·4	95·2	62·5	134·7	57·2	0·54
6	29·973	63·8	79·3	55·6	70·4	59·0	116·7	47·3	0·75
7	30·023	60·9	70·5	51·6	69·0	57·0	115·7	54·6	0·71
8	29·960	60·1	74·0	49·1	68·6	53·0	118·4	48·0	0·67
9	29·890	58·7	75·2	48·7	68·2	44·8	112·9	38·7	0·70
10	29·761	60·0	72·0	52·7	70·2	49·0	114·9	43·9	0·77
11	29·920	57·7	71·0	46·8	66·6	51·0	114·9	46·2	0·67
12	30·100	57·4	68·8	48·1	68·1	45·5	116·2	40·0	0·71
13	30·058	58·1	73·1	50·8	68·2	45·1	112·4	40·3	0·77
14	29·980	60·1	68·1	52·2	68·9	53·1	103·4	46·3	0·75
15	29·939	64·8	77·3	55·4	77·0	52·9	118·8	49·6	0·72
16	29·953	71·1	79·3	53·5	88·2	51·9	126·4	47·0	0·54
17	29·989	76·4	85·7	55·7	91·1	60·8	127·9	56·9	0·49
18	30·002	74·9	77·4	58·6	89·9	66·0	131·4	62·0	0·57
19	29·930	73·9	78·0	63·1	84·1	66·3	..	64·4	0·69
20	29·791	64·1	66·7	60·0	72·9	61·2	116·8	60·1	0·87
21	29·877	51·3	57·6	44·7	63·7	52·0	111·8	50·0	0·78
22	29·983	56·8	57·1	46·5	62·4	50·5	111·0	47·2	0·69
23	29·965	56·1	55·5	45·3	61·7	50·1	101·6	47·0	0·69
24	30·084	58·0	62·0	49·4	71·0	43·4	117·1	38·1	0·73
25	29·970	63·2	62·8	53·3	74·7	54·0	100·2	50·0	0·70
26	30·028	58·9	60·6	49·6	65·4	55·0	114·0	54·1	0·71
27	30·114	66·8	58·5	45·0	63·0	53·2	117·0	..	0·65
28	30·152	56·3	58·5	48·8	63·9	50·0	110·0	47·6	0·76
29	30·197	57·3	61·5	47·1	66·5	50·8	109·0	..	0·69
30	30·182	57·6	62·0	50·6	65·4	51·1	114·2	49·0	0·78
31	30·168	57·5	64·5	49·5	67·3	46·2	115·9	44·1	0·75
Means & Sums	29·983	62·0	69·5	52·2	72·4	53·3	116·2	49·6	0·71

GENERAL ABSTRACT:

BAROMETER:—

Maximum, 30·246 inches, on the 29th.
Minimum, 29·644 inches, on the 5th.
Range in the month, 0·602 inches.
Mean for the month, 29·983 inches, being 0·010 inches higher than the average for the preceding fifteen years.

TEMPERATURE OF AIR:—

Highest in the shade, 95·2°, on the 5th.
Lowest in the shade, 43·4°, on the 24th.
Range in the month, 51·8°.
Greatest daily range, 36·3°, on the 16th.
Least daily range, 9·8°, on the 27th.
Mean daily range, 19·1°.
Mean for the month, 62·0°, being 1·9° lower than the average for the preceding fifteen years.

TEMPERATURE OF SOIL:—

On Surface—Mean, 69·5°, being 0·9° lower than the average for the preceding fourteen years.
Bulb 14 inches deep—Maximum, 54·0°; minimum, 44·2°; range in the month, 9·8°; mean, 49·7.

Observatory for the Month ending 31st March 1873.

Height above Sea-level, 91 feet.

Day of Month.	Wind. Prevailing Direction.	Amount of Rain.	Remarks.
		inches.	
1	S.	0·040	Dull, showery, and squally in a.m.; fine, with strong cool breeze, in p.m.
2	S.E.	0	Heavy dew; fine and pleasant all day.
3	S.E. and S. ..	0	Heavy dew; fine, but cloudy in a.m.; very fine and clear in p.m.
4	W. and S. ..	0·010	Dense fog in morning; very fine and clear in p.m.
5	N. and N.E. ..	0	Dense fog in early morning; fine and clear, but hot and boisterous, until 6 p.m., when the wind went round to S., blowing fresh and cool.
6	S. and S.E. ..	0·007	Very fine and pleasant.
7	S. and S.E. ..	0	Fine and pleasant, but dull.
8	S.E. and S. ..	0	Very fine and pleasant; cloudy in a.m.
9	S.E.	0	Very heavy dew; very fine and pleasant. Aurora Australis in evening.
10	S.	0	Heavy dew; fine and pleasant in a.m.; rather boisterous in afternoon.
11	S. and W. ..	0	Boisterous in a.m.; very fine and pleasant in p.m.
12	S. and S.E. ..	0	Heavy dew; fine and pleasant all day.
13	S. and S.E. ..	0	Heavy dew; delightful weather; cool breeze.
14	S.E.	0	Fine, but dull, all day; clear in evening.
15	S.E.	0	Very fine, cool, and pleasant.
16	N.E. and N. ..	0	Heavy dew; fine and clear, but hot and boisterous.
17	N.E. and N. ..	0	Fine and clear, but very hot. Sheet lightning in S. in evening.
18	N.E. and N. ..	0	Very hot and sultry; dull, with scattered rain, in p.m. Sheet lightning in S. 9 p.m.
19	S.E. and N.E...	0·018	Dull and very sultry, with light rain showers.
20	W. and S. ..	0·277	Dull and showery.
21	W.	0·107	Strong westerly gale and rain squalls.
22	S.W.	0·231	Gale moderating towards morning; dull, squally and showery, and cold.
23	S.W. and W ..	0·194	Dull, with rain squalls.
24	N.W. and S.W.	0	Heavy dew; fine and pleasant and mild.
25	N.E. and N. ..	0·017	Fine and mild, but dull; drizzling rain in evening.
26	S.	0·806	Heavy showers in night; dull and squally in a.m.; fine, but boisterous, in p.m.
27	S.	0·006	Fine and pleasant, but dull.
28	S.W. and S. ..	0·060	Fine, but dull, in a.m.; very boisterous, with occasional rain squalls, in p.m.
29	W.	0	Fine, but rather boisterous.
30	W. and S. ..	0·063	Fine and mild; light rain shower at 8 a.m. and in evening.
31	E. and S. ..	0	Heavy dew; fine and pleasant all day; dull in evening.
..	..	1·836	

MARCH 1873.

Temperature of Soil—*continued*:—

Bulb 3 feet deep—Maximum, 69·2°; minimum, 64·2°; range in the month, 5·0°; mean, 67·5°, being 0·4° lower than the average for the preceding eleven years.

Bulb 6 feet deep—Maximum, 68·2°; minimum, 66·6°; range in the month, 1·6°; mean, 67·7°, being 0·3° lower than the average for the preceding eleven years.

Bulb 8 feet deep—Maximum, 65·8°; minimum, 65·0°; range in the month, 0·8°; mean, 65·4°, being 0·8° lower than the average for the preceding eleven years.

Solar Radiation:—

Maximum, 134·7°, on the 5th.

Terrestrial Radiation:—

Minimum, 38·1°, on the 24th, and 38·7°, on the 9th.

Humidity of Air:—

Mean, 71 (that of Saturation being represented by 100), being 4 higher than the average for the preceding fifteen years, and the highest on record during that period.

Temperature of Dew-point:—

Mean, 52·2°, being 0·4° higher than the average for the preceding fourteen years.

Results of Meteorological Observations made at Melbourne

Lat. 37° 49′ 53″ S. Long. 9h. 39m. 54·8s. E.

Day of Month.	Barometer reduced to 32° Fahrenheit.	Mean Temperature.			Self-registering Thermometers.				Humidity.
					In Shade.		Radiation.		
	Mean.	Air.	Surface Soil.	Dew-point.	Max.	Min.	Solar Max.	Terrestrial Min.	Mean.
	inches.	°	°	°	°	°	°	°	Sat. = 1.
1	30·094	57·5	60·8	47·4	67·2	51·3	108·0	46·3	0·69
2	30·123	54·8	59·6	46·8	62·6	48·0	110·8	45·1	0·75
3	30·173	55·1	63·4	46·3	62·2	48·0	105·1	44·3	0·73
4	30·199	55·5	62·9	49·9	65·7	43·9	107·0	39·1	0·82
5	30·254	59·5	68·6	53·7	71·0	51·3	111·6	46·9	0·81
6	30·182	63·3	70·8	53·8	80·2	48·8	121·0	45·0	0·71
7	30·095	68·7	75·3	54·4	85·1	55·0	123·2	50·2	0·60
8	29·990	68·2	74·0	49·3	84·2	55·0	122·9	50·6	0·51
9	29·958	64·7	66·0	57·1	80·0	60·6	116·9	59·2	0·77
10	30·013	58·3	61·4	49·4	63·0	55·1	89·1	53·9	0·72
11	29·918	59·5	64·6	53·1	64·8	55·1	95·1	54·2	0·79
12	29·948	62·3	67·9	57·8	69·5	57·1	110·0	55·1	0·85
13	30·018	65·6	71·5	58·2	76·6	57·2	117·0	55·0	0·77
14	29·897	62·3	64·9	57·9	71·8	56·5	97·0	53·8	0·86
15	29·709	61·2	62·2	56·2	71·0	57·0	86·9	55·0	0·84
16	29·559	61·0	66·1	57·5	67·0	55·8	110·2	53·5	0·88
17	29·605	59·1	62·2	52·3	66·6	56·0	109·2	55·5	0·78
18	29·771	60·1	63·5	56·5	67·7	55·9	111·9	54·9	0·88
19	29·930	64·3	66·2	57·9	74·4	59·0	116·0	57·0	0·80
20	29·867	61·7	67·0	55·1	75·5	50·8	112·1	46·0	0·79
21	29·737	66·7	67·5	57·3	79·3	56·0	118·0	51·6	0·72
22	29·707	62·7	64·7	54·9	74·2	57·2	114·0	56·1	0·76
23	29·835	57·1	58·2	46·1	67·3	52·0	109·0	49·1	0·67
24	30·013	52·2	54·5	47·3	59·1	48·7	88·0	43·9	0·84
25	30·145	56·7	57·3	50·5	67·0	47·6	101·7	42·0	0·80
26	30·087	58·1	59·3	49·1	70·7	49·8	110·9	43·4	0·72
27	29·850	56·8	59·2	48·9	71·6	53·0	109·0	47·1	0·75
28	29·757	48·4	49·6	43·9	57·0	42·2	90·0	38·2	0·84
29	30·064	56·1	54·5	45·3	61·8	45·3	105·7	..	0·67
30	30·174	52·5	53·3	47·2	60·5	49·8	102·1	48·7	0·82
Means & Sums	29·956	59·7	63·2	52·0	69·8	52·6	107·6	49·7	0·76

GENERAL ABSTRACT:

Barometer:—

Maximum, 30·296 inches, on the 5th.
Minimum, 29·523 inches, on the 16th.
Range in the month, 0·773 inches.
Mean for the month, 29·956 inches, being 0·070 inches lower than the average for the preceding fifteen years.

Temperature of Air:—

Highest in the shade, 85·1°, on the 7th.
Lowest in the shade, 42·2°, on the 28th.
Range in the month, 42·9°.
Greatest daily range, 31·4°, on the 6th.
Least daily range, 7·9°, on the 10th.
Mean daily range, 17·2°.
Mean for the month, 59·7°, being 0·9° higher than the average for the preceding fifteen years.

Temperature of Soil:—

On Surface—Mean, 63·2°, being 1·8° higher than the average for the preceding fifteen years.
Bulb 14 inches deep—Maximum, 48·0°; minimum, 40·1°; range in the month, 7·9°; mean, 45·1°.

Observatory for the Month ending 30th April 1873.

Height above Sea-level, 91 feet.

Day of Month.	Wind. — Prevailing Direction.	Amount of Rain.	Remarks.
		inches.	
1	S.	0·089	Fine and pleasant in a.m.; light rain showers in afternoon.
2	W. and S. ..	0·051	Light showers and dull in a.m.; fine in p.m.
3	S.E. and S.W.	0	Heavy dew; beautiful clear day.
4	S.E. and S. ..	0	Heavy dew; very fine and pleasant.
5	E. and S. ..	0	Heavy dew; very fine and clear.
6	S.W. and N.E.	0	Heavy dew and thick fog in early morning; very fine, but hot, afterwards.
7	N.E.	0	Fine, clear, and hot.
8	N. and N.E. ..	0	Fine, but hot and rather boisterous; lunar halo 9 p.m.
9	N.W. and W.	0·016	Dull, hazy, and sultry; light scattered rain in p.m.
10	S.E. and S. ..	0·030	Fine, but dull.
11	S.E.	0	Fine, but dull.
12	S.W.	0	Fine, but dull and sultry.
13	S.W.	0·034	Heavy dew; fine in a.m.; thunder and lightning in afternoon and evening.
14	E.	0·006	Dense fog in a.m.; fine, but dull, in p.m.
15	E. and N. ..	0·098	Fine, but dull and sultry: light rain showers in evening.
16	S.W.	0·040	Dull and showery; heavy rain at 10 p.m. and through the night.
17	S.W.	0·795	Dull and showery.
18	S. and W. ..	0·025	Dull and gloomy in morning and evening; fine in afternoon.
19	S.E.	0·013	Fine, and very warm; clear in evening.
20	E.	0	Dense fog in a.m.; fine and very warm in p.m.
21	N. and N.E. ..	0	Heavy dew; fine and very warm; gloomy and showery in evening.
22	N.W. and N.E.	0·255	Dull and showery in early a.m.; fine and very mild remainder; slight shock of an earthquake at 4.30 p.m.
23	N.W. and W.	0·019	Fine, but boisterous, with scattered rain; cold and squally in evening.
24	N.W. and W.	0·061	Dull and showery.
25	N.W.	0	Fine, but dull.
26	N. and N.W. ..	0	Fine and mild.
27	N. and N.W. ..	0·009	Fine in a.m.; squally, with scattered rain, in p.m.
28	W. and N.W	0·389	Cold, boisterous, squally, and showery; strong gale and heavy squalls in evening.
29	S. and S.W. ..	0·025	Gale moderating, but still boisterous and squally.
30	S. and S.E. ..	0·112	Fine and pleasant in a.m.; dull and showery in p.m.
..	..	2·067	

APRIL 1873.

Temperature of Soil—*continued.*

Bulb 3 feet deep—Maximum, 65·1°; minimum, 62·0°; range in the month, 3·1°; mean, 64·3°, being 0·3° higher than the average for the preceding twelve years.

Bulb 6 feet deep—Maximum, 66·3°; minimum, 65·0°; range in the month, 1·3°; mean, 65·7°, being 0·1° higher than the average for the preceding twelve years.

Bulb 8 feet deep—Maximum, 65·0°; minimum, 63·9°; range in the month, 1·1°; mean, 64·4°, being 0·6° lower than the average for the preceding twelve years.

Solar Radiation:—
Maximum, 123·2°, on the 7th.

Terrestrial Radiation:—
Minimum, 38·2°, on the 28th.

Humidity of Air:—
Mean, 76 (that of Saturation being represented by 100), being 3 higher than the average for the preceding fifteen years.

Temperature of Dew-point:—
Mean, 52·0°, being 2·5° higher than the average for the preceding fourteen years.

Results of Meteorological Observations made at Melbourne

Lat. 37° 49′ 53″ S. Long. 9h. 39m. 54·8s. E.

Day of Month.	Barometer reduced to 32° Fahrenheit.	Mean Temperature.			Self-registering Thermometers.				Humidity.
					In Shade.		Radiation.		
	Mean.	Air.	Surface Soil.	Dew-point.	Max.	Min.	Solar Max.	Terrestrial Min.	Mean.
	inches.	°	°	°	°	°	°	°	Sat. = 1.
1	30·095	54·2	57·2	48·1	61·4	47·8	102·0	45·2	0·80
2	29·880	54·8	55·6	45·9	65·2	45·0	100·9	40·0	0·72
3	29·675	56·8	53·9	46·0	64·0	53·7	91·6	..	0·67
4	29·500	58·0	56·6	47·9	69·3	54·8	107·7	50·2	0·69
5	29·469	56·5	55·1	49·8	63·0	52·2	82·1	47·2	0·79
6	29·602	59·4	58·4	49·6	68·1	51·6	108·4	46·9	0·70
7	29·559	61·1	57·9	46·6	69·2	57·1	82·2	53·0	0·50
8	29·586	65·3	59·0	44·7	70·6	54·8	76·1	53·1	0·47
9	29·937	56·6	57·3	46·1	60·0	52·4	102·8	50·0	0·68
10	30·226	50·2	51·6	42·6	64·0	39·0	104·0	32·1	0·75
11	30·185	54·6	56·0	43·9	65·6	42·9	103·4	36·2	0·67
12	30·056	59·8	59·8	45·5	69·6	54·0	103·0	50·1	0·59
13	29·959	59·4	60·2	43·2	69·0	53·2	101·5	48·8	0·55
14	30·144	53·3	55·7	43·9	60·0	45·5	98·2	45·0	0·70
15	29·998	56·3	55·8	45·3	66·5	41·2	96·9	36·0	0·67
16	30·032	52·4	54·7	39·5	59·9	46·8	95·5	45·0	0·61
17	30·210	50·9	52·6	43·0	59·8	43·8	93·0	38·9	0·74
18	30·167	49·4	51·7	40·9	61·5	40·5	98·4	34·3	0·72
19	30·188	53·0	55·9	47·0	61·3	47·3	98·2	41·6	0·80
20	30·182	50·1	52·3	44·2	62·8	44·5	94·4	40·1	0·80
21	30·052	53·1	53·9	45·9	65·9	41·9	96·3	37·9	0·76
22	30·026	54·9	55·5	51·2	58·9	50·6	67·7	46·9	0·87
23	30·133	56·0	56·6	53·3	62·2	52·1	79·9	50·3	0·91
24	30·017	56·7	55·9	53·7	61·2	52·8	65·2	49·8	0·90
25	29·958	57·8	57·5	53·9	67·2	54·0	97·4	49·0	0·87
26	30·115	52·2	54·7	48·4	58·0	49·0	94·0	44·2	0·87
27	30·190	50·5	53·1	43·2	57·9	45·3	100·7	39·9	0·76
28	30·276	48·1	51·0	42·7	57·0	40·8	95·2	39·0	0·81
29	30·187	48·9	49·2	41·7	65·2	37·6	98·1	33·0	0·76
30	29·939	56·3	51·5	47·1	65·9	45·9	91·1	39·0	0·71
31	29·850	57·6	55·8	51·9	68·2	52·2	102·0	50·9	0·81
Means & Sums	29·980	55·0	55·2	46·3	64·0	48·1	94·4	43·8	0·73

GENERAL ABSTRACT:

Barometer:—

Maximum, 30·311 inches, on the 28th.
Minimum, 29·406 inches, on the 5th.
Range in the month, 0·905 inches.
Mean for the month, 29·980 inches, being 0·029 inches lower than the average for the preceding fifteen years.

Temperature of Air:—

Highest in the shade, 70·6°, on the 8th.
Lowest in the shade, 37·6°, on the 29th.
Range in the month, 33·0°.
Greatest daily range, 27·6°, on the 29th.
Least daily range, 8·3°, on the 22nd, 8·4°, on the 24th.
Mean daily range, 15·9°.
Mean for the month, 55·0°, being 1·8° higher than the average for the preceding fifteen years, and the highest on record during that period, with the exception of May 1866, when it reached 56·4°.

Temperature of Soil:—

On Surface—Mean, 55·2°, being 1·6° higher than the average for the preceding fifteen years.
Bulb 14 inches deep—Maximum, 41·0°; minimum, 36·2°; range in the month, 4·8°; mean, 39·4°.

Observatory for the Month ending 31st May 1873.

Height above Sea-level, 91 feet.

Day of Month.	Wind. Prevailing Direction.	Amount of Rain.	Remarks.
		inches.	
1	W. and S.W.	0·047	Dull and showery in a.m.; fine in p.m.
2	N.	0	Fine and pleasant.
3	N.	0·002	Dull, with scattered rain.
4	N.	0·057	Fine and mild in a.m.; dull and showery in p.m.
5	N. and N.W.	0·037	Dull, squally, and showery.
6	N. and N.W.	0·047	Dull, but fine.
7	N.	0	Very boisterous and dusty; light showers in evening.
8	N.	0·037	Dull and very warm.
9	W. and N.W.	0	Fine and cool.
10	W. and N.E.	0	Heavy dew; frosty morning; very fine all day.
11	N.	0	Heavy dew; fine and mild, but dull.
12	N.	0	Fine and very mild.
13	N.	0	Fine and mild, but boisterous.
14	W. and S.W.	0	Fine and pleasant.
15	N. and N.E.	0	Heavy dew; frosty morning; fine all day; boisterous and very warm in evening. Solar halo in a.m.
16	W.	0·010	Strong N. wind all night; fine, clear, with strong cool W. wind all day.
17	W.	0	Fine in a.m.; dull in p.m.
18	W. and N.W.	0	Heavy dew; fine, but dull.
19	N.W.	0·029	Fine, but dull; drizzling rain in evening.
20	N.W.	0·021	Foggy in early morning; very fine and pleasant all day.
21	N.E. and N. ..	0	Heavy dew; fine, but dull.
22	N.	0·366	Dull and showery.
23	N.E.	0·036	Drizzling rain in a.m.; dull and gloomy all day.
24	N. and N.E. ..	0·047	Dull and showery.
25	N.	0·366	Dull and showery, and very mild.
26	W. and S.W.	0·131	Dull, with drizzling rain.
27	N.W. and S. ..	0	Dull and cold all day; lightning in S.W. in evening.
28	S.E.	0·013	Dull in a.m.; fine and pleasant in p.m.
29	N.E.	0	Heavy dew; very fine and pleasant all day.
30	N.E.	0·044	Fine in a.m.; dull and showery in p.m.
31	N. and N.W.	0·020	Fine and mild, but dull, all day; clear in evening.
..	..	1·310	

MAY 1873.

Temperature of Soil—*continued.*

Bulb 3 feet deep—Maximum, 61·6°; minimum, 57·9°; range in the month, 3·7°; mean, 60·1°, being 1·6° higher than the average for the preceding twelve years.

Bulb 6 feet deep— Maximum, 64·9°; minimum, 61·5°; range in the month, 3·4°; mean, 63·0°, being 1·3° higher than the average for the preceding twelve years.

Bulb 8 feet deep—Maximum, 63·7°; minimum, 61·1°; range in the month, 2·6°; mean, 62·5°, being 0·2° higher than the average for the preceding twelve years.

Solar Radiation:—

Maximum, 108·4°, on the 6th.

Terrestrial Radiation:—

Minimum, 32·1°, on the 10th, and 33·0°, on the 29th.

Humidity of Air:—

Mean, 73 (that of Saturation being represented by 100), being 5 lower than the average for the preceding fifteen years.

Temperature of Dew-point:—

Mean, 46·3°, being 0·2° higher than the average for the preceding fourteen years.

Results of Meteorological Observations made at Melbourne

Lat. 37° 49′ 53″ S. Long. 9h. 39m. 54·8s. E.

Day of Month.	Barometer reduced to 32° Fahrenheit.	Mean Temperature.			Self-registering Thermometers.				Humidity.
					In Shade.		Radiation.		
	Mean.	Air.	Surface Soil.	Dew-point.	Max.	Min.	Solar Max.	Terrestrial Min.	Mean.
	inches.	°	°	°	°	°	°	°	Sat.=1.
1	29·772	58·6	56·3	52·5	68·0	50·3	101·0	46·2	0·80
2	29·853	55·8	53·6	46·7	65·1	49·0	98·0	43·3	0·71
3	29·979	56·5	54·7	48·1	67·7	51·2	104·3	45·3	0·74
4	30·172	53·2	53·9	51·0	62·0	51·0	90·3	48·8	0·92
5	30·028	54·8	55·2	49·1	62·5	48·6	97·1	45·0	0·81
6	29·647	58·1	59·1	55·2	66·1	52·3	91·0	51·2	0·90
7	29·668	56·7	56·9	53·3	63·5	53·4	85·8	52·0	0·88
8	29·729	57·8	54·3	48·2	64·4	51·7	94·0	47·1	0·71
9	29·866	55.6	54·1	49·0	65·0	50·2	106·0	45·0	0·79
10	30·088	54·8	54·3	49·1	61·8	49·5	82·8	48·9	0·91
11	30·200	50·5	50·0	44·8	64·3	43·9	95·9	38·0	0·81
12	30·125	48·4	49·0	45·6	55·7	40·0	77·0	35·0	0·90
13	29·994	51·5	52·9	49·9	54·7	49·7	61·7	47·1	0·94
14	30·183	47·5	49·1	44·5	59·4	41·0	93·0	37·1	0·89
15	30·260	47·3	48·7	41·5	57·5	39·1	96·4	36·0	0·80
16	30·158	46·3	48·6	44·3	57·0	37·0	84·9	33·2	0·92
17	29·930	54·4	54·5	52·7	58·9	48·4	65·0	45·1	0·94
18	29·873	55·6	56·5	54·5	58·4	53·1	64·8	50·3	0·96
19	29·753	52·6	54·7	50·5	57·9	46·8	72·2	45·0	0·93
20	29·865	48·3	47·7	42·5	57·0	44·1	95·2	41·3	0·80
21	30·119	51·0	50·3	47·7	58·4	45·1	98·5	40·7	0·89
22	30·340	49·9	51·7	45·0	59·4	45·0	95·8	43·2	0·83
23	30·468	51·4	52·2	44·7	61·0	42·0	95·0	38·1	0·78
24	30·490	51·5	52·5	46·3	56·7	47·9	68·8	42·9	0·83
25	30·389	49·9	52·5	46·7	55·4	47·0	93·1	45·1	0·89
26	30·337	48·1	50·0	43·8	61·4	42·5	93·6	39·0	0·85
27	30·262	48·9	47·3	41·3	63·2	38·0	95·8	32·5	0·75
28	29·960	55·3	49·4	43·7	59·2	44·2	81·0	36·8	0·65
29	29·812	49·8	50·7	44·2	58·0	46·5	89·0	46·7	0·81
30	30·024	47·4	49·7	44·3	57·4	40·7	95·9	37·0	0·89
Means & Sums	30·045	52·2	52·3	47·3	60·6	46·3	88·8	42·8	0·84

GENERAL ABSTRACT:

Barometer:—

Maximum, 30·527 inches, on the 23rd; 30·524, on the 24th.
Minimum, 29·597 inches, on the 6th.
Range in the month, 0·930 inches.
Mean for the month, 30·045 inches, being 0·045 inches higher than the average for the preceding fifteen years.

Temperature of Air:—

Highest in the shade, 68·0°, on the 1st.
Lowest in the shade, 37·0°, on the 16th.
Range in the month, 31·0°.
Greatest daily range, 25·2°, on the 27th.
Least daily range, 5·0°, on the 13th.
Mean daily range, 14·3°.
Mean for the month, 52·2°, being 2·5° higher than the average for the preceding fifteen years, and together with June 1867, when it reached the same amount, the highest on record.

Temperature of Soil:—

On Surface—Mean, 52·3°, being 3·0° higher than the average for the preceding fifteen years, and the highest on record.
Bulb 14 inches deep—Maximum, 39·0°; minimum, 33·2°; range in the month, 5·8°; mean, 36·2°.

Observatory for the Month ending 30th June 1873.

Height above Sea-level, 91 feet.

Day of Month.	Wind. Prevailing Direction.	Amount of Rain.	Remarks.
		inches.	
1	N.	0	Fine and mild.
2	N.	0	Heavy dew; very fine and clear morning and evening; boisterous in afternoon.
3	N.	0·089	Fine and pleasant in a.m.; dull and showery in p.m.
4	S.E.	0·015	Thick fog 7 a.m.; dull and misty all day; fine and clear in evening, and heavy dew.
5	S.E.	0·018	Heavy dew; fine all day; dull and showery in evening.
6	S. and S.W. ..	0·111	Drizzling rain in a.m.; dull and sultry in p.m.; lunar halo in evening.
7	N. and N.W...	0·100	Dull and sultry, with misty rain.
8	N.E.	0	Dull, but fine and cool all day; heavy squall, with rain, 9.30 p.m.
9	N.	0·119	Fine and pleasant in a.m.; boisterous and threatening in p.m.
10	N.	0	Fine and pleasant all day.
11	N.	0	Heavy dew; very fine and clear in a.m.; cloudy, but fine, in p.m.; lunar halo in evening.
12	S.E.	0·138	Heavy dew; fine and pleasant in a.m.; light steady rain in p.m.
13	W. and N.W...	0·517	Steady soaking rain in a.m.; dull, misty, and showery in p.m.
14	N.W. and S...	0	Heavy dew; very fine and clear all day; dense fog, and very cold, in evening.
15	E. and S. ..	0	Dense fog in night; fine, but hazy, all day; clear, with heavy dew in evening.
16	N.E.	0	Thick fog in a.m.; fine, but dull, in p.m.; light rain showers in evening.
17	N.E. and S. ..	0·424	Dull and misty all day; steady soaking rain and sultry in p.m.
18	S.W. and S. ..	0·434	Drizzling rain in a.m.; thick, misty, and foggy all day.
19	S.W. and W...	0·017	Drizzling rain in a.m.; dull and cold in p.m.
20	W.	0·150	Fine and pleasant in a.m.; dull and cold, with rain squalls, in p.m.
21	W. and S.W...	0·017	Fine and pleasant.
22	S.W. and W...	0·114	Fine and mild, with occasional showers; rain squalls in evening.
23	Westerly ..	0·067	Fine and pleasant, though dull.
24	S.W.	0·029	Fine, but dull and hazy; drizzling rain in evening.
25	S.W.	0·075	Drizzling rain in a.m.; fine, but dull, in p.m.
26	N.E.	0	Dense fog in a.m.; very fine and clear in p.m.; heavy dew in evening.
27	N.E. and N. ..	0	Heavy dew; very fine and clear all day.
28	N. and N.E. ..	0	Fine, but dull and boisterous.
29	W.	0·216	Dull and showery, with heavy squall at 12.30 p.m.
30	W. and S.W. ..	0·038	Fine, but dull in a.m.; showery in p.m.
..	..	2·688	

JUNE 1873.

Temperature of Soil—*continued.*

Bulb 3 feet deep—Maximum, 58·5°; minimum, 54·9°; range in the month, 3·6°; mean, 56·9°, being 3·4 higher than the average for the preceding twelve years, and the highest on record during that period.

Bulb 6 feet deep—Maximum, 61·4°; minimum, 58·7°; range in the month, 2·7°; mean, 60·2°, being 3·0° higher than the average for the preceding twelve years, and the highest on record during that period.

Bulb 8 feet deep—Maximum, 61·2°; minimum, 59·1°; range in the month, 2·1°; mean, 60·1°, being 1·0° higher than the average for the preceding twelve years, and the highest on record during that period, with the exception of June 1871, when it reached 60·3°.

Solar Radiation:—

Maximum, 106·0°, on the 9th.

Terrestrial Radiation:—

Minimum, 32·5°, on the 27th, and 33·2°, on the 16th.

Humidity of Air:—

Mean, 84 (that of Saturation being represented by 100), being 3 higher than the average for the preceding fifteen years, and the highest on record during that period, with the exception of June 1858, when it reached 88.

Temperature of Dew-point:—

Mean, 47·3°, being 3·4° higher than the average for the preceding fourteen years, and the highest on record during that period.

Results of Meteorological Observations made at Melbourne

Lat. 37° 49′ 53″ S. Long. 9h. 39m. 54·8s. E.

Day of Month.	Barometer reduced to 32° Fahrenheit.	Mean Temperature.			Self-registering Thermometers.				Humidity.
					In Shade.		Radiation.		
	Mean.	Air.	Surface Soil.	Dew-point.	Max.	Min.	Solar Max.	Terrestrial Min.	Mean.
	inches.	°	°	°	°	°	°	°	Sat. = 1.
1	30·041	50·1	52·5	46·3	56·8	47·0	91·4	44·2	0·87
2	29·962	48·0	49·9	42·6	58·5	42·2	95·3	38·0	0·81
3	29·920	50·0	49·5	41·6	58·2	44·3	89·7	38·2	0·73
4	29·939	49·6	49·4	42·6	59·0	41·3	90·8	35·8	0·77
5	29·929	48·3	48·5	42·2	57·5	44·7	91·0	42·7	0·79
6	29·973	48·8	48·7	43·3	58·4	42·6	89·4	39·0	0·81
7	29·943	49·6	48·8	44·7	56·5	44·5	91·0	43·2	0·83
8	30·177	49·4	51·0	44·7	58·0	44·9	92·8	40·2	0·84
9	30·132	49·3	49·5	43·5	55·5	45·7	92·1	42·9	0·80
10	30·184	48·5	48·4	41·8	57·9	42·3	89·0	36·9	0·77
11	29·905	51·6	48·6	41·4	57·0	44·9	95·3	38·0	0·68
12	29·870	46·1	46·0	40·5	58·2	43·0	92·6	38·1	0·81
13	29·854	46·2	45·0	39·6	53·7	39·1	85·1	33·6	0·78
14	29·812	53·2	49·2	44·1	60·1	44·0	88·8	44·2	0·71
15	29·937	48·6	48·5	44·7	55·1	46·0	68·0	..	0·86
16	30·107	46·9	47·9	42·9	54·3	42·0	61·6	38·3	0·86
17	30·191	43·5	45·3	39·5	54·1	37·9	70·7	33·0	0·85
18	30·231	40·3	44·0	38·1	51·4	30·2	88·4	25·1	0·92
19	30·247	44·0	47·3	43·1	54·2	34·9	68·0	31·0	0·96
20	30·348	45·8	45·7	40·8	55·0	37·2	82·0	32·2	0·83
21	30·349	43·1	46·3	40·2	52·3	35·8	86·8	32·6	0·90
22	30·223	42·2	43·1	35·2	56·7	31·3	92·0	27·9	0·76
23	30·125	43·2	44·9	36·4	59·5	31·0	94·0	26·1	0·77
24	30·156	44·6	45·0	39·3	58·8	36·1	97·6	31·1	0·82
25	30·300	43·2	45·5	40·1	55·0	34·7	..	29·4	0·89
26	30·347	41·9	48·2	41·2	48·0	38·2	84·0	34·0	0·97
27	30·129	42·5	44·1	40·7	56·5	31·8	89·0	29·0	0·93
28	30·239	43·5	45·0	40·4	53·0	36·2	92·0	32·7	0·89
29	30·337	44·7	47·0	42·6	52·0	40·6	95·8	37·6	0·92
30	30·274	43·5	48·0	37·5	57·5	33·8	91·5	31·0	0·79
31	30·164	48·8	46·1	38·5	63·9	33·4	100·2	27·9	0·67
Means & Sums	30·108	46·4	47·3	41·3	56·2	39·4	87·9	35·1	0·83

GENERAL ABSTRACT:

Barometer:—

Maximum, 30·421 inches, on the 26th.
Minimum, 29·744 inches, on the 11th.
Range during the month, 0·677 inches.
Mean for the month, 30·108 inches, being 0·116 inches higher than the average for the preceding fifteen years.

Temperature of Air:—

Highest in the shade, 63·9°, on the 31st
Lowest in the shade, 30·2°, on the 18th.
Range during the month, 33·7°.
Greatest daily range, 30·5°, on the 31st.
Least daily range, 9·1°, on the 15th.
Mean daily range, 16·8°.
Mean for the month, 46·4°, being 1·4° lower than the average for the preceding fifteen years.

Temperature of Soil:—

On Surface—Mean, 47·3°, being 0·3° lower than the average for the preceding fifteen years.
Bulb 14 inches deep—Maximum, 34·8°; minimum, 29·3°; range in the month, 5·5°; mean, 31·6°.

Observatory for the Month ending 31st July 1873.

High above Sea-level, 91 feet.

Day of Month.	Wind. — Prevailing Direction.	Amount of Rain.	Remarks.
		inches.	
1	W. and S.W.	0·082	Dull, with drizzling rain.
2	N. and N.W.	0·037	Dull and hazy in a.m.; fine, clear, and cold in p.m.
3	N.	0·008	Fine, but dull and rather boisterous.
4	N.E. and N. ..	0	Fine and mild.
5	N.E.	0·107	Dull and showery.
6	N.E. and N. ..	0	Fine, but dull.
7	S.W.	0·068	Boisterous, showery, and squally; calm in evening.
8	S.W. and W.	0·128	Fine; occasionally light rain showers.
9	S.W.	0·117	Cold, squally, and showery.
10	N. and N.W.	0	Very fine and pleasant.
11	N.	0	Fine, but very boisterous.
12	W.	0·077	Very fine and clear in a.m.; cold, squally, and showery in p.m.
13	N.W. and N.	0·180	Fine in a.m.; dull, with squalls of rain and hail, in p.m.; lightning in W. all evening.
14	W. and N. W.	0·005	Strong Westerly gale all day and heavy squalls.
15	S.W.	0·066	Gale abating during morning; boisterous, squally, and cold in p.m.
16	S.W.	0·124	Dull, with light rain showers.
17	S.E.	0·009	Very fine and pleasant.
18	S.E. and E. ..	0	Hoar frost and ice in early morning; very fine all day.
19	S.E.	0·019	Heavy fog in early morning; fine and cold all day.
20	S.E.	0	Heavy dew; fine and cold; dull in afternoon, clear in evening.
21	N.E. and S.W.	0·012	Dense fog in a.m.; very fine and clear in p.m.
22	N.E.	0·017	Hoar frost in early morning; very fine and clear all day.
23	N.E. and N. ..	0·013	Hoar frost and ice in early morning; very fine and clear all day.
24	N.E. and S.W.	0	Hoar frost in early morning; fine and pleasant all day.
25	N.E. and S.W.	0·017	Heavy dew; fine all day; very dense fog in evening.
26	S.W.	0·015	Dense fog during night, and in a.m., and in evening; fine part of afternoon.
27	S.W.	0·179	Fine, but dull in a.m.; cold, with rain squalls in p.m.
28	W. and S.W.	0·033	Dull, cold, and showery.
29	W. and S.W.	0·086	Dull, with misty rain, in a.m.; fine, clear, and cold, in p.m.
30	N.E. and N. ..	0	Thick fog in early morning; very fine and clear all day.
31	N.E.	0	Hoar frost and ice in early morning; clear and cold in a.m.; cloudy and mild in p.m.
..	..	1·399	

JULY 1873.

Temperature of Soil—*continued*:—

Bulb 3 feet deep—Maximum, 54·4°; minimum, 50·1°; range in the month, 4·3°; mean, 52·4°, being 1·7° higher than the average for the preceding twelve years.

Bulb 6 feet deep—Maximum, 58·7°; minimum, 55·0°; range in the month, 3·7°; mean, 56·8°, being 2·1° higher than the average for the preceding twelve years.

Bulb 8 feet deep—Maximum, 59·1°; minimum, 56·2°; range in the month, 2·7°; mean, 56·8°, being 2·1° higher than the average for the preceding twelve years.

Solar Radiation:—

Maximum, 100·2°, on the 31st.

Terrestrial Radiation:—

Minimum, 25·1°, on the 18th.

Humidity of Air:—

Mean, 83 (that of Saturation being represented by 100), being 2 higher than the average for the preceding fifteen years.

Temperature of Dew-point:—

Mean, 41·3°, being 0·5° lower than the average for the preceding fourteen years.

Results of Meteorological Observations made at Melbourne

Lat. 37° 49′ 53″ S. Long. 9$^{h.}$ 39$^{m.}$ 54·8$^{s.}$ E.

Day of Month.	Barometer reduced to 32° Fahrenheit.	Mean Temperature.			Self-registering Thermometers.				Humidity.
		Air.	Surface Soil.	Dew-point.	In Shade.		Radiation.		
	Mean.				Max.	Min.	Solar Max.	Terrestrial Min.	Mean.
	inches.	°	°	°	°	°	°	°	Sat. = 1.
1	29·980	57·0	52·9	47·7	59·0	54·0	63·5	50·0	0·71
2	29·902	58·7	57·0	49·2	67·2	54·7	100·0	50·0	0·71
3	30·060	51·4	53·2	45·7	60·8	45·0	89·0	43·0	0·81
4	29·990	54·3	54·5	44·4	65·0	42·8	100·7	37·7	0·69
5	29·891	49·7	54·9	40·0	58·6	44·1	92·8	38·6	0·69
6	29·651	48·3	48·0	41·6	58·3	40·1	72·7	33·9	0·78
7	29·561	50·1	50·5	46·1	59·0	46·0	99·9	38·0	0·86
8	29·876	49·6	51·7	42·9	59·3	45·0	102·0	40·7	0·77
9	30·087	46·5	49·1	39·7	54·4	42·2	94·6	39·1	0·77
10	30·204	50·1	50·8	39·8	61·3	41·2	100·0	35·2	0·68
11	30·174	51·4	49·4	42·8	57·2	46·8	80·0	40·0	0·73
12	29·924	52·1	50·0	44·7	57·1	47·1	65·9	43·9	0·76
13	29·838	55·5	55·4	49·1	62·7	49·7	100·0	46·9	0·79
14	29·802	52·4	51·7	44·7	59·5	45·0	97·2	40·0	0·75
15	29·760	51·7	50·8	41·8	62·5	39·6	100·4	33·8	0·69
16	29·417	54·6	53·6	45·7	65·0	47·0	105·5	42·0	0·72
17	29·771	47·4	49·5	41·4	58·2	41·6	99·2	37·2	0·80
18	30·004	50·2	49·2	42·6	61·0	41·6	99·7	..	0·75
19	29·850	52·4	51·0	43·7	61·0	48·3	101·7	43·2	0·72
20	30·114	48·8	50·8	43·1	57·1	41·9	97·3	38·6	0·81
21	30·143	51·9	51·8	43·6	60·7	45·1	97·6	39·1	0·74
22	30·126	51·4	52·9	44·2	64·9	46·0	102·2	40·0	0·76
23	30·072	48·7	53·3	45·5	55·9	40·1	84·2	33·8	0·89
24	30·032	49·6	54·2	44·7	58·4	44·0	102·2	42·4	0·83
25	30·087	49·3	54·4	43·8	57·2	42·5	99·1	38·1	0·81
26	29·938	51·1	53·0	42·9	65·7	39·7	106·1	35·9	0·74
27	29·871	58·3	58·7	46·9	69·0	48·1	109·3	44·3	0·66
28	29·932	59·3	59·0	48·7	71·5	54·3	112·4	48·1	0·68
29	30·010	50·7	52·1	39·6	61·7	45·2	97·1	40·0	0·66
30	30·087	50·6	53·3	43·7	58·9	44·3	103·0	38·9	0·77
31	30·229	49·8	54·4	37·8	56·0	45·3	104·0	42·5	0·63
Means & Sums	29·948	51·7	52·6	43·8	60·8	45·1	96·1	40·5	0·75

GENERAL ABSTRACT :

BAROMETER :—

Maximum, 30·255 inches, on the 31st ; and 30·245 inches, on the 10th.
Minimum, 29·340 inches, on the 16th.
Range during the month, 0·915 inches.
Mean for the month, 29·948 inches, being 0·047 inches lower than the average for the preceding fifteen years.

TEMPERATURE OF AIR :—

Highest in the shade, 71·5°, on the 28th.
Lowest in the shade, 39·6°, on the 15th ; 39·7°, on the 26th.
Range in the month, 31·9°.
Greatest daily range, 26·0°, on the 26th.
Least daily range, 5·0°, on the 1st.
Mean daily range, 15·7°.
Mean for the month, 51·7°, being 1·7° higher than the average for the preceding fifteen years.

TEMPERATURE OF SOIL :—

On Surface—Mean, 52·6°, being 2·0° higher than the average for the preceding fifteen years, and the highest on record during that period, the next highest, 52·5°, having occurred in 1860.

Observatory for the Month ending 31st August 1873.

Height above Sea-level, 91 feet.

Day of Month.	Wind. Prevailing Direction.	Amount of Rain.	Remarks.
		inches.	
1	N. and N.E. ..	0·018	Dull and boisterous, with scattered rain.
2	N. and N.W. ..	0·008	Fine and mild, but dull, in a.m.; very fine in p.m.
3	S.	0	Fine and mild, but dull, in a.m.; very fine in p.m.
4	N. and N.E. ..	0	Fine and pleasant all day; rain squall 9 p.m.
5	N.	0·070	Fine and pleasant.
6	N.E.	0·122	Heavy dew; fine, but dull, in a.m.; light rain in p.m.
7	W. and S.W. ..	0·592	Dull and gloomy, with light, soaking rain.
8	N.W. and W...	0	Fine and pleasant; heavy dew in evening.
9	W. and S.W. ..	0·074	Showery until 9 a.m.; very fine all day.
10	N. and N.W. ..	0	Very fine and mild.
11	N.	0	Dull and cold; steady rain at 10 p.m.
12	N.	0·457	Dull and gloomy, with light rain.
13	N.	0·079	Very fine and mild.
14	N. and W. ..	0·033	Fine and mild in a.m.; cold, boisterous, and squally in p.m.; evening clear.
15	N.	0	Heavy dew; very fine and clear in a.m.; boisterous and squally in p.m.
16	N.W. and N. ..	0·359	Very boisterous and squally all day; heavy rain showers in evening.
17	W. and N.W. ..	0·032	Very boisterous and squally all day; evening fine and clear.
18	N. and N.W. ..	0·003	Dull and misty.
19	N.W. and N. ..	0·079	Fine, but dull.
20	W.	0	Fine and pleasant.
21	N.W.	0	Fine and pleasant, but dull.
22	S.E. and N.E...	0	Fine and mild, but dull; clear in evening, with heavy dew.
23	S.W. and S.E...	0·014	Dense fog in morning; very fine in afternoon.
24	S.	0	Heavy dew; very foggy in a.m.; fine in p.m.; clear evening.
25	S.W. and W. ..	0	Fine, but foggy in a.m.; very fine and clear in p.m.; heavy dew in evening.
26	N.E.	0	Dense fog in a.m.; fine and very mild after.
27	N. and W. ..	0	Fine and pleasant, and very warm.
28	N.	0·008	Dull, and very warm, and much dust; rain squall at 7.45 p.m.
29	W.	0·042	Very fine in a.m.; cold, boisterous, and squally in p.m.; evening clear.
30	S.W. and W. ..	0·010	Fine, but dull.
31	S.E. and S.W...	0·072	Fine and cold.
..	..	2·072	

AUGUST 1873.

Temperature of Soil—*continued.*

Bulb 14 inches deep—Maximum, 35·2°; minimum, 31·0°; range in the month, 4·2°; mean, 32·8°.
Bulb 3 feet deep—Maximum, 54·0°; minimum, 50·2°; range in the month, 3·8°; mean, 52·3°, being 2·0° higher than the average for the preceding twelve years.
Bulb 6 feet deep—Maximum, 55·2°; minimum, 54·8°; range in the month, 0·4°; mean, 54·9°, being 1·6° higher than the average for the preceding twelve years.
Bulb 8 feet deep—Maximum, 56·2°; minimum, 55·4°; range in the month, 0·8°; mean, 55·7°, being 1·3° higher than the average for the preceding twelve years.

Solar Radiation:—
Maximum, 112·4°, on the 28th.

Terrestrial Radiation:—
Minimum, 33·8°, on the 15th and 23rd.

Humidity of Air:—
Mean, 75 (that of Saturation being represented by 100), being 1 lower than the average for the preceding fifteen years.

Temperature of Dew-point:—
Mean, 43·8°, being 1·7° higher than the average for the preceding fourteen years.

Results of Meteorological Observations made at Melbourne

Lat. 37° 49′ 53″ S. Long. 9$^{h.}$ 39$^{m.}$ 54·8$^{s.}$ E.

Day of Month.	Barometer reduced to 32° Fahrenheit.	Mean Temperature.			Self-registering Thermometers.				Humidity.
					In Shade.		Radiation.		
	Mean.	Air.	Surface Soil.	Dew-point.	Max.	Min.	Solar Max.	Terrestrial Min.	Mean.
	inches.	°	°	°	°	°	°	°	Sat. = 1.
1	30·202	46·4	53·1	40·6	60·5	34·5	97·2	28·9	0·80
2	30·019	54·0	58·0	42·6	72·3	37·7	110·3	32·1	0·65
3	29·492	59·2	57·8	49·3	68·4	55·0	106·4	51·0	0·70
4	29·685	44·6	47·3	35·3	52·8	40·8	95·0	..	0·70
5	30·032	48·1	49·3	36·2	54·0	39·2	99·9	..	0·64
6	30·062	49·2	52·0	40·2	54·5	43·1	97·2	40·0	0·71
7	29·989	48·0	51·0	40·7	59·2	42·0	98·8	39·1	0·76
8	29·766	52·9	52·8	40·0	65·8	39·1	103·8	34·5	0·62
9	29·803	52·6	56·5	47·2	60·0	47·2	100·8	40·6	0·82
10	29·820	51·4	52·9	47·5	62·2	43·3	91·1	40·0	0·87
11	29·785	51·0	54·8	44·2	60·6	42·6	108·8	39·1	0·77
12	29·571	51·2	52·7	43·5	61·0	44·4	97·9	39·9	0·75
13	29·527	49·9	48·9	42·0	63·5	46·0	109·2	41·8	0·74
14	29·622	48 8	50·1	37·8	57·8	43·0	101·5	39·0	0·66
15	29·836	53·0	52·4	41·7	61·2	44·8	87·3	39·0	0·65
16	29·840	54·4	56·1	46·8	66·0	48·8	105·8	47·8	0·76
17	29·828	56·1	55·6	46·8	73·3	45·0	114·9	40·0	0·71
18	29·713	58·0	60·6	47·8	68·4	47·1	111·3	40·9	0·69
19	29·687	57·2	58·3	48·2	68·3	49·7	111·2	44·5	0·72
20	29·622	52·2	54·2	43·8	65·5	43·9	109·0	38·8	0·73
21	29·867	48·0	52·9	41·2	56·8	44·7	100·2	41·0	0·77
22	30·081	52·4	54·6	44·0	65·8	39·4	109·8	33·6	0·73
23	30·016	61·8	61·7	48·6	72·2	51·3	113·8	46·0	0·62
24	30·137	53·3	56·2	45·6	60·0	48·2	89·8	46·0	0·75
25	29·895	62·0	59·3	46·6	78·7	45·1	110·0	40·0	0·57
26	30·129	54·4	59·2	49·3	61·4	50·6	111·9	49·0	0·83
27	30·078	55·2	60·4	45·1	73·4	41·8	113·4	35·6	0·69
28	29·654	65·8	62·2	47·1	79·5	54·0	113·0	45·1	0·51
29	29·989	53·3	57·9	41·7	61·0	47·4	106·9	42·4	0·65
30	30 085	54·9	59·7	45·8	62·6	49·4	106·9	48·1	0·71
Means & Sums	29·861	53·3	55·3	43·9	64·2	45·0	104·4	40·8	0·71

GENERAL ABSTRACT:

BAROMETER:—

Maximum, 30·284 inches, on the 1st.
Minimum, 29·345 inches, on the 3rd.
Range in the month, 0·939 inches.
Mean for the month, 29·861 inches, being ·0057 inches lower than the average for the preceding fifteen years.

TEMPERATURE OF AIR:—

Highest in the shade, 79·5°, on the 28th, which is the highest on record for the preceding fifteen years.
Lowest in the shade 34·5°, on the 1st.
Range in the month, 45·0°.
Greatest daily range, 34·6°, on the 2nd.
Smallest daily range, 10·8°, on the 26th.
Mean daily range, 19·2°.
Mean for the month, 53·3°, being the same as the average for the preceding fifteen years.

TEMPERATURE OF SOIL:—

On Surface—Mean, 55·3°, being 1·1° higher than the average for the preceding fourteen years.
Bulb 14 inches deep—Maximum, 38·1°; minimum, 33·0°; range in the month, 5·1°; mean, 35·3°.

Observatory for the Month ending 30th September 1873.

Height above Sea-level, 91 feet.

Day of Month.	Wind. — Prevailing Direction.	Amount of Rain.	Remarks.
		inches.	
1	S.E.	0	Heavy dew; beautiful, clear day.
2	N.E. and N. ..	0	Heavy dew; fine and warm.
3	N.	0·027	Fine and warm in a.m.; thunder in S. in p.m.; dull in evening, with lightning in S.W.
4	W.	0·407	Cold, boisterous, and squally all day; strong gale, with heavy rain and hail, all night.
5	S.	0·105	Boisterous and squally all day, with light rain showers occasionally.
6	S.W.	0·516	Showery and squally in a.m; fine and pleasant in p.m.
7	W.	0	Fine and pleasant all day.
8	N.E.	0	Heavy dew; fine and mild.
9	S.W. and S. ..	0	Fine and very mild; clear, with heavy dew, in evening.
10	N.E.	0·237	Heavy dew; fine, but dull, all day; heavy rain showers in evening.
11	W. and N.W..	0·314	Very fine all day; clear in a.m.; passing clouds in p.m.
12	N. and N.E. ..	0·315	Dull and showery all day; fine and mild in evening.
13	N. and N.W...	0·200	Dull and boisterous, with heavy rain squalls; sheet lightning in evening in S.S.E.
14	W.	0·097	Cold, boisterous, and squally.
15	N.W. and W..	0	Fine and pleasant, but dull.
16	W. and N.W..	0	Fine and very warm; clear in evening, with heavy dew.
17	N.E. and N. ..	0	Heavy dew; fine but sultry.
18	N.E. and S. ..	0	Fine, but sultry, in a.m.; fine and pleasant in p.m., with heavy dew in evening.
19	S.W.	0	Heavy dew; fine, but sultry in a.m.; cool and clear in p.m.
20	N. and N.W...	0·090	Fine, but boisterous, with rain squalls in afternoon; evening clear.
21	W. and N.W..	0·092	Showery and squally in a.m.; fine in p.m.; clear and cold in evening.
22	N. and N.W...	0	Heavy dew; fine and pleasant, but dull all day.
23	N.	0	Fine, but very warm, and boisterous.
24	S.E. and S. ..	0	Fine, but dull, all day; evening clear, with heavy dew.
25	N.E. and N. ..	0·046	Heavy dew; hot and very boisterous, with clouds of dust; light rain in evening.
26	S. and W. ..	0·113	Fine and mild, but dull, all day; evening clear.
27	N.E.	0	Heavy dew; delightful weather all day.
28	N. and W. ..	0·013	Very hot, boisterous, and dusty in a.m.; light rain showers in p.m.
29	W.	0	Fine, cool, and pleasant.
30	W. and S. ..	0	Fine and pleasant, but dull.
..	..	2·572	

SEPTEMBER 1873.

Temperature of Soil—*continued.*

Bulb 3 feet deep—Maximum, 56·4°; minimum, 53·1°; range in the month, 3·3°; mean, 54·2°, being 0·9° higher than the average for the preceding eleven years.

Bulb 6 feet deep—Maximum, 56·3°; minimum, 55·2°; range in the month, 1·1°; mean, 55·5°, being 0·9° higher than the average for the preceding eleven years.

Bulb 8 feet deep—Maximum, 55·9°; minimum, 55·3°; range in the month, 0·6°; mean, 55·5°; being 0·7° higher than the average for the preceding eleven years.

Solar Radiation:—

Maximum, 114·9°, on the 17th.

Terrestrial Radiation:—

Minimum, 28·9°, on the 1st.

Humidity of Air:—

Mean, 71 (that of Saturation being represented by 100) being 1 lower than the average for the preceding fifteen years.

Temperature of Dew-point:—

Mean, 43·9°, being the same as the average for the preceding fourteen years.

Results of Meteorological Observations made at Melbourne

Lat. 37° 49′ 53″ S. Long. 9h. 39m. 54·8s. E.

Day of Month.	Barometer reduced to 32° Fahrenheit.	Mean Temperature.			Self-registering Thermometers.				Humidity.
		Air.	Surface Soil.	Dew-point.	In Shade.		Radiation.		
	Mean.				Max.	Min.	Solar Max.	Terrestrial Min.	Mean.
	inches.	°	°	°	°	°	°	°	Sat. = 1.
1	30·043	52·7	57·9	46·5	62·0	47·0	112·2	42·3	0·79
2	29·851	60·1	63·4	51·6	76·2	47·7	114·1	43·0	0·74
3	29·881	57·1	56·6	45·9	64·3	52·5	104·9	49·0	0·66
4	30·047	50·0	55·3	40·0	55·5	46·5	107·0	44·2	0·68
5	29·858	51·9	57·9	40·8	68·5	35·6	100·0	29·7	0·66
6	29·651	53·9	54·5	46·5	62·8	49·5	82·0	46·6	0·76
7	30·045	53·5	56·0	42·4	58·3	48·7	104·7	46·1	0·66
8	30·224	52·3	62·2	45·5	60·9	47·1	104·4	..	0·78
9	30·165	54·9	66·2	40·5	72·4	36·0	114·4	31·1	0·58
10	30·015	59·5	60·0	45·7	68·9	48·1	110·9	39·8	0·60
11	29·936	56·3	59·2	52·2	65·4	52·8	98·7	50·7	0·86
12	29·925	55·1	57·1	46·7	64·4	47·7	100·0	42·8	0·74
13	29·984	55·7	62·9	47·4	65·3	51·2	111·2	47·0	0·74
14	30·053	57·4	70·5	46·6	70·1	45·0	113·0	38·8	0·67
15	29·908	65·8	74·9	43·5	82·5	50·3	122·2	44·4	0·45
16	29·784	74·0	81·5	50·3	89·8	54·7	127·1	46·9	0·43
17	29·719	63·9	65·2	51·3	65·2	59·8	83·8	58·0	0·64
18	29·966	57·3	60·0	45·6	66·0	53·0	110·0	49·6	0·65
19	30·129	55·4	64·6	47·0	63·7	48·7	120·5	44·1	0·74
20	30·052	56·0	72·3	48·6	67·0	42·2	111·2	36·2	0·76
21	29·841	67·7	77·1	49·8	82·7	47·9	121·2	42·7	0·53
22	29·650	68·6	72·0	46·9	79·3	55·8	115·4	50·0	0·46
23	30·017	54·9	69·7	44·8	65·4	49·0	116·2	43·8	0·69
24	29·894	66·7	78·7	44·7	80·9	43·0	121·2	38·1	0·45
25	29·712	66·9	75·8	45·6	79·0	57·5	120·0	55·0	0·46
26	29·623	59·7	67·4	46·0	74·0	50·0	118·0	43·4	0·61
27	29·852	56·3	63·3	45·0	68·2	46·6	115·3	39·9	0·66
28	29·955	56·9	69·3	48·9	70·0	47·4	117·8	41·3	0·75
29	29·747	69·3	74·8	51·9	85·3	48·1	120·8	43·2	0·54
30	29·507	74·9	72·4	51·0	84·3	64·7	109·8	57·6	0·43
31	29·450	53·3	56·8	49·9	64·0	49·0	77·0	44·0	0·88
Means & Sums	29·886	59·3	65·6	46·7	70·4	49·1	109·8	44·3	0·65

GENERAL ABSTRACT:

Barometer :—

Maximum, 30·272 inches, on the 8th.
Minimum, 29·377 inches, on the 31st.
Range in the month, 0·895 inches.
Mean for the month, 29·886 inches, being 0·007 inches higher than the average for the preceding fifteen years.

Temperature of Air :—

Highest in the shade, 89·8°, on the 16th.
Lowest in the shade, 35·6°, on the 5th.
Range in the month, 54·2°.
Greatest daily range, 37·9°, on the 24th; 37·2°, on the 29th.
Least daily range, 5·4°, on the 17th.
Mean daily range, 21·3°.
Mean for the month, 59·3°, being 2·3° higher than the average for the preceding fifteen years, and the highest on record during that period, the next highest, 58·7°, having occurred in October 1861.

Temperature of Soil :—

On Surface—Mean, 65·6°, being 3·9° higher than the average for the preceding fifteen years, and the highest on record during that period with the exception of October 1868, when it reached 65·9°.

Observatory for the Month ending 31st October 1873.

Height above Sea-level, 91 feet.

Day of Month.	Wind. Prevailing Direction.	Amount of Rain.	Remarks.
		inches.	
1	S.W.	0	Fine, but dull.
2	N.E. and N. ..	0·169	Thunder at 3.15 a.m.; hot and boisterous, with occasional rain showers.
3	W. and S.W...	0·032	Fine and mild in a.m.; squally and showery in p.m.
4	S. and S.W. ..	0·032	Light showers at 6 a.m.; fine and cool all day; lunar halo in evening.
5	N.E.	0·264	Heavy dew; fine in a.m.; dull in p.m.; showery in evening.
6	W.	0·302	Fine, but dull, in a.m.; showery in p.m.
7	S.W. and W...	0·021	Dull and squally in a.m.; fine, but cold and boisterous, in p.m.
8	S.W.	0·006	Very fine, cool and pleasant all day; clear in evening.
9	E. and N. ..	0	Hoar frost and ice in early morning; very fine and clear all day.
10	N. and N.E. ..	0	Fine and very warm in a.m.; dull and sultry in p.m.; scattered rain at 5 p.m.
11	S. and S.E. ..	0·070	Dull and sultry all day, with light rain at intervals.
12	W.	0·008	Fine, but dull, in a.m.; light rain squalls in p.m.; fine in evening.
13	S.	0·003	Dull and boisterous, with scattered rain, in a.m.; fine, but squally, in p.m.
14	N.	0	Heavy dew; very fine and clear all day.
15	N. and N.E. ..	0	Fine, but very hot and boisterous.
16	N. and N.E. ..	0	Fine and clear, but very hot, all day.
17	N.	0·352	Dull and sultry, with distant thunder at intervals, and rain showers in afternoon.
18	W. and N.W..	0·015	Fine, but dull and boisterous.
19	S. and W. ..	0	Fine and pleasant, but dull; clear in evening, with heavy dew.
20	S. and S.E. ..	0	Heavy dew; very fine, clear, and cool all day.
21	N.E. and N. ..	0	Heavy dew; fine, clear, and very hot.
22	W. and N. ..	0	Dull, boisterous, and very warm in a.m.; evening fine and clear.
23	W. and S. ..	0	Very fine and pleasant all day, with cool breeze; clear evening and heavy dew.
24	N. and N.E. ..	0	Heavy dew; fine, but hot and sultry.
25	N. and S. ..	0	Hot and very boisterous and dusty in a.m.; fine and pleasant in p.m.; lightning in N.E. in evening.
26	W. and S. ..	0·037	Light rain showers in a.m.; fine in p.m.; heavy gusts of wind in evening.
27	W.	0·044	Fine, but squally, all day; a few light rain showers in afternoon.
28	N.W. and S. ..	0	Dull in a.m.; fine and pleasant all day.
29	N.E. and N. ..	0	Dense fog at 6 a.m.; fine, but hot and boisterous, all day; thunder, 4 to 5 p.m.
30	N.	0	Thunder and lightning in a m.; dull and very hot all day; lightning in W. and S.W. in evening.
31	W. and S.W...	1·566	Heavy rain in night; dull and squally, with rain showers, all day.
..	..	2·921	

OCTOBER 1873.

Temperature of Soil—*continued.*

Bulb 14 inches deep—Maximum, 44·0°; minimum, 35·9; range in the month, 8·1°; mean, 39·8°.

Bulb 3 feet deep—Maximum, 61·2°; minimum, 55·9°; range in the month, 5·3°; mean, 58·2°, being 1·1° higher than the average for the preceding twelve years.

Bulb 6 feet deep—Maximum, 60·0°; minimum 56·4°; range in the month, 3·6°; mean, 57·8°, being 0·8° higher than the average for the preceding twelve years.

Bulb 8 feet deep—Maximum, 58·0°; minimum, 55·9°; range in the month, 2·1°; mean, 56·8°, being 0·5° higher than the average for the preceding twelve years.

Solar Radiation:—

Maximum, 127·1°, on the 16th.

Terrestrial Radiation:—

Minimum, 29·7°, on the 5th.

Humidity of Air:—

Mean, 65 (that of Saturation being represented by 100), being, together with October 1868, 6 lower than the average for the preceding fifteen years, and the lowest on record during that period.

Temperature of Dew-point:—

Mean, 46·7°, being 0·1° lower than the average for the preceding fourteen years.

Results of Meteorological Observations made at Melbourne

Lat. 37° 49′ 53″ S. Long. 9h. 39m. 54·8s. E.

Day of Month.	Barometer reduced to 32° Fahrenheit.	Mean Temperature.			Self-registering Thermometers.				Humidity.
		Air.	Surface Soil.	Dew-point.	In Shade.		Radiation.		
	Mean.				Max.	Min.	Solar Max.	Terrestrial Min.	Mean.
	inches.	°	°	°	°	°	°	°	Sat. = 1..
1	29·697	56·6	57·3	44·5	68·6	44·1	117·0	39·8	0·64
2	29·915	56·6	59·1	46·1	68·5	50·0	114·0	46·0	0·68
3	30·040	57·6	67·0	47·2	67·2	43·3	104·0	37·9	0·69
4	29·832	70·9	78·0	51·4	84·0	46·8	121·0	41·0	0·50
5	29·791	57·0	58·8	49·0	62·8	55·0	109·1	50·0	0·75
6	29·963	53·7	61·6	43·9	61·0	45·2	111·3	42·3	0·69
7	29·970	54·4	64 8	44·1	61·0	49·3	109·4	46·8	0·68
8	29·839	57·2	65·8	46·8	67·2	52·8	116·5	50·2	0·68
9	29·771	53·8	62·7	45·6	63·0	48·8	115·0	47·0	0·74
10	29·951	53·1	58·5	48·4	62·3	50·0	110·4	47·0	0 84
11	30·047	56·7	62·0	47·3	65·9	50·5	116·3	47·9	0·71
12	29·763	57·8	64·6	51·3	68·0	42·6	113·1	36 1	0·79
13	29 693	53·6	57·5	50·4	62·0	53·0	89·6	52·0	0·89
14	29 932	54·6	62·2	47·8	66·1	49·1	116·0	45·4	0·78
15	30·044	55·4	63·9	47·7	63·0	46·9	112·0	43·0	0·75
16	29·996	57·9	69 7	47·4	67·8	43·0	110·3	36·2	0·68
17	29·953	56·5	65·6	49·2	70·3	52·2	119·9	48·1	0·77
18	30·032	54·6	64·6	43·4	64·1	47·4	110·2	42·8	0·66
19	30·020	59·3	71·2	47·6	70·4	46·7	118·9	43 0	0·65
20	29·970	60·0	73·4	50·7	80·2	47·5	120·1	41·1	0·71
21	29·937	59·2	68·3	52·4	67·6	54·0	120·0	50·0	0·78
22	30·086	56·4	66·3	45·2	64·3	53·6	116·4	52·8	0·66
23	30·056	61·7	73·8	50·8	73·0	45·2	118·0	39·2	0·68
24	29·960	57·8	68·8	50·1	68·0	49·9	115·0	45·0	0·76
25	29·901	60·4	71·7	49·4	68·1	46·8	112·9	41·1	0·67
26	29·840	62·8	73·1	49·9	74·2	48·1	117·2	42·0	0·63
27	29·823	60·4	75·3	52·2	69·3	51·3	120·0	45·8	0·74
28	29·817	58·6	71·3	48·1	66·1	51·6	117·7	47·9	0·68
29	29·901	56·5	62·6	44·5	64·0	52·1	117·0	48·7	0·64
30	30·033	61·3	72·6	46·5	74·2	49·0	120·0	45·0	0·58
Means & Sums	29·919	57·7	66·4	48·0	67·7	48·9	114·3	44·7	0·70

GENERAL ABSTRACT:

Barometer:—

Maximum, 30·129 inches, on the 23rd.
Minimum, 29·575 inches, on the 13th.
Range in the month, 0·554 inches.
Mean for the month, 29·919 inches, being 0·043 inches higher than the average for the preceding fifteen years.

Temperature of Air:—

Highest in the shade, 84·0° on the 4th.
Lowest in the shade, 42·6°, on the 12th.
Range in the month, 41·4°.
Greatest daily range, 37·2°, on the 4th.
Least daily range, 7·8°, on the 5th.
Mean daily range, 18·8°.
Mean for the month, 57·7°, being 3·3° lower than the average for the preceding fifteen years, and the lowest on record during that period, the next lowest, 58·0°, having occurred in November 1866.

Temperature of Soil:—

On Surface—Mean, 66·4°, being 2·4° lower than the average for the preceding fifteen years.
Bulb 14 inches deep—Maximum, 45·0°; minimum, 39·5°; range in the month, 5·5°; mean, 41·7°.

Observatory for the Month ending 30th November 1873.

Height above Sea-level, 91 feet.

Day of Month.	Wind. Prevailing Direction.	Amount of Rain.	Remarks.
		inches.	
1	N.W. and W.	0·017	Dull and boisterous, with heavy squalls: sultry in evening.
2	N.W.	0·042	Boisterous and squally in a.m.; fine and pleasant in p.m.
3	S. rnd S.E. ..	0	Heavy dew; very fine and pleasant.
4	N.E. and N. ..	0	Heavy dew; fine, clear, and hot; evening dull and sultry.
5	S. and S.W. ..	0·428	Thunderstorm in night; dull and showery in a.m.; fine in p.m.
6	S. and S.W. ..	0·087	Showery in night; fine, with cool, fresh breeze, all day.
7	S. and S.W. ..	0	Fine and pleasant; evening dull.
8	S. and S.W. ..	0·050	Fine, but dull, all day; showery in evening.
9	S.E. and S.W.	0·240	Showers in night; fine and pleasant all day; evening dull and showery.
10	S.E.	0·142	Dull and boisterous, with rain squalls.
11	S.E.	0	Fine, but dull, in a.m.; clear in p.m.
12	S.	0·037	Heavy dew; fine all day; lightning in evening, and rain showers.
13	S.E. and S. ..	0·244	Dull, cold, and showery.
14	S.E.	0·007	Fine and pleasant.
15	S.E. and S. ..	0	Heavy dew; very fine and pleasant.
16	S.	0	Fine and pleasant.
17	S.E. and S. ..	0·068	Dull and sultry, with occasional rain showers.
18	S. and S.W. ..	0·007	Fine and pleasant all day; evening clear and cold.
19	S.E.	0	Delightful weather; heavy dew in night.
20	S.	0	Heavy dew; fine, but hot, in a.m.; afternoon cool.
21	S.	0	Fine, but dull,
22	S.	0	Dull in a.m.; fine and cool in p.m.
23	S. and S.E. ..	0	Heavy dew; fine and pleasant all day.
24	S.W. and S. ..	0	Fine, cool, and pleasant all day.
25	S.E.	0	Heavy dew; fine, cool, and pleasant all day.
26	S. and E. ..	0	Heavy dew; very fine; warm in a.m.; cool in p.m.
27	S. and S.E. ..	0	Heavy dew; fine in a.m.; dull and threatening in p.m.
28	S. and S.E. ..	0	Heavy dew; fine, but cloudy, with cold fresh wind.
29	S.	0·040	Squally, with light rain showers in a.m.; fine, with strong, cool breeze, in p.m.
30	S.E.	0	Heavy dew; very fine and pleasant all day; evening clear.
..	..	1·409	

NOVEMBER 1873.

Temperature of Soil—*continued*:—

Bulb 3 feet deep—Maximum, 62·6°; minimum, 60·0°; range in the month, 2·6°; mean, 60·7°, being 0·9° lower than the average for the preceding twelve years.

Bulb 6 feet deep—Maximum, 61·9°; minimum, 60·0°; range in the month, 1·9°; mean, 60·5°, being the same as the average for the preceding twelve years.

Bulb 8 feet deep—Maximum 59·6°; minimum, 58·0°; range in the month, 1·6°; mean, 58·7°, being the same as the average for the preceding twelve years.

Solar Radiation:—

Maximum, 121·0°, on the 4th, which is the lowest maximum on record during the preceding fourteen years.

Terrestrial Radiation:—

Minimum, 36·1°, on the 12th, and 36·2°, on the 16th.

Humidity of Air:—

Mean, 70 (that of Saturation being represented by 100), being 3 higher then the average for the preceding fifteen years.

Temperature of Dew-point:—

Mean, 48·0°, being 0·9° lower than the average for the preceding fourteen years.

Results of Meteorological Observations made at Melbourne

Lat. 37° 49′ 53″ S. Long. 9h. 39m. 54·8s. E.

Day of Month.	Barometer reduced to 32° Fahrenheit.	Mean Temperature.			Self-registering Thermometers.				Humidity.
		Air.	Surface Soil.	Dew-point.	In Shade.		Radiation.		
	Mean.				Max.	Min.	Solar Max.	Terrestrial Min.	Mean.
	inches.	°	°	°	°	°	°	°	Sat. = 1.
1	30·067	63·0	74·3	49·9	74·3	45·0	119·0	38·6	0·63
2	20·996	68 8	79·3	49·8	83·6	49·4	126·1	43·0	0·51
3	29·941	69·8	80·3	53·2	86·3	52·0	126·1	45·3	0 56
4	29·846	68·4	81·3	54·5	78·8	53·6	121·0	47·9	0·61
5	29·776	74·5	84 1	54·0	93·7	52·6	133·0	47·1	0·49
6	29·845	77·0	87·1	53·5	93·0	57·5	133·4	52·1	0·44
7	29·884	74·5	83·0	51·9	90·0	57·6	134·0	51·4	0·45
8	29·756	80·4	88·5	57·2	101·2	56·2	140·0	50·8	0·45
9	29·567	86·3	93·9	60·7	100·6	69·3	142·0	66·1	0·42
10	29·471	75·2	76·1	54·5	87·4	61·0	107·0	56·0	0·49
11	29·614	68·3	73·3	52·9	80·9	54·7	127·0	50·8	0·58
12	29·703	66·1	73·8	48·4	80·0	52·6	120·9	45·0	0·53
13	29 904	60·5	70·0	48·5	73·0	50·0	120·0	45·6	0·65
14	29·942	66·4	..	48·3	86·8	44·9	128·0	37·7	0·52
15	29·816	78·9	..	49·1	100·1	56·0	137·9	..	0·35
16	29·827	66·4	67·5	57·3	87·0	60·4	130·0	56·0	0·72
17	29·926	60·2	62·3	46·2	69·3	55·0	117·6	54·0	0·60
18	29·775	66·5	69·5	44·8	81·1	50·8	111·7	46·3	0·46
19	29·439	65·4	67·1	46·2	78·9	57·4	115·0	53·3	0·50
20	29·653	60·2	60·9	47·5	73·0	55·0	119·0	..	0·63
21	29·578	57·9	48·2	47·5	67·4	53·5	105·4	50·0	0·68
22	29·777	59·8	65·4	42·3	73·7	45·4	120·3	41·1	0·52
23	29·862	61·1	66·6	48·1	71·2	53·9	118·1	48·0	0·62
24	29·876	64·4	72 2	48·8	79·0	47·1	122·0	40·8	0·57
25	29·656	66·1	76·0	54·7	78·0	51·2	121·0	46·0	0·67
26	29·848	57·8	65·9	43·4	69·7	53·2	114·0	47·0	0·59
27	30·038	57·7	70·9	41·4	70·0	46·1	115·0	41·1	0·55
28	29·777	75·9	84·0	49·0	98·5	48·2	134·0	42·1	0·39
29	29·945	63·6	68·0	53·2	70·1	59·0	117·5	58·0	0·69
30	30·164	60·2	67·0	47·8	71·1	51·4	121·0	47·1	0·64
31	30·137	60·8	72·6	48·7	69·7	55·9	114·1	53·1	0·65
Means & Sums	29·819	67·2	73·4	50·1	81·2	53·4	122·9	48·3	0·55

GENERAL ABSTRACT:

Barometer:—

Maximum, 30·201 inches, on the 30th.
Minimum, 29·350 inches, on the 10th.
Range in the month, 0·851 inches.
Mean for the month, 29·819 inches, being 0·010 inches higher than the average for the preceding fifteen years.

Temperature of Air:—

Highest in the shade, 101·2°, on the 8th.
Lowest in the shade, 44·9°, on the 14th; and 45·0°, on the 1st.
Range in the month, 56·3°.
Greatest daily range, 50·3°, on the 28th.
Smallest daily range, 11·1°, on the 29th.
Mean daily range, 27·8°.
Mean for the month, 67·2°, being 3·6° higher than the average for the preceding fifteen years, and the highest on record, with the exception of December 1859, when it reached 67·9°.

Temperature of Soil:—

On Surface—Mean, 73·4°, being 0·1° lower than the average for the preceding fifteen years.

Observatory for the Month ending 31st December 1873.

Height above Sea-level, 91 feet.

Day of Month.	Wind. Prevailing Direction.	Amount of Rain.	Remarks.
		inches.	
1	E. and S.E. ..	0	Heavy dew; very fine and clear.
2	S.E. and N.E..	0	Heavy dew; fine, clear, hot.
3	S.	0	Heavy dew; fine and clear, but very hot.
4	S. and W. ..	0	Fine, but sultry, in a.m.; very fine, clear, and cool in p.m.
5	N. and N.W...	0	Heavy dew; fine and clear, but very hot.
6	N.E. and S.E..	0	Fine, clear, and very hot; sheet lightning in S. during evening.
7	N.E. and S. ..	0	Fine, but hot and sultry.
8	N.E. and N. ..	0	Fine, but very hot and oppressive.
9	N.E. and N. ..	0	Very hot and boisterous, with clouds of dust.
10	S.E.	0·295	Hot wind all night; round to S.W. at 9 a.m., followed by rain showers; thunder and lightning in S.W. during evening; and smart shower at 7 p.m.
11	N.W. and S.W.	0	Heavy dew; fine and pleasant all day; sheet lightning in S. during evening.
12	W.	0	Heavy dew; fine, rather boisterous; shower at 11 p.m.
13	S. and W. ..	0·039	Fine and cool.
14	S.E.	0	Heavy dew; fine, but hot and sultry.
15	N.	0	Hot wind and clouds of dust; wind round to S. at 6.30 p.m.; blowing fresh and cool.
16	S.	0	Dull, sultry, and very hazy in a.m.; fine and cool, but cloudy, in p.m.
17	S. and S.E. ..	0·012	Fine, cool, and pleasant.
18	N. and S.E. ..	0	Dull, close, and sultry.
19	W. and N.W..	0	Hot and boisterous in a.m.; stormy westerly gale set in at 11 a.m., with heavy squalls and dust clouds.
20	W.	0·010	Dull, with squalls occasionally, and scattered rain.
21	W.	0·110	Fine and cool, but squally; rain showers shortly after 9 a.m.
22	W.	0	Heavy dew; very fine, cool, and pleasant.
23	S. and S.E. ..	0	Fine and pleasant.
24	S. and S.E. ..	0	Fine and pleasant.
25	S.E. and N.E..	0	Heavy dew; delightful weather; cool, gentle breeze.
26	W. and S.W...	0	Fine and cool, with occasional squalls; a few rain squalls after 1 p.m.
27	S. and W. ..	0	Very fine, clear, and cool.
28	N.E. and N. ..	0	Fine and clear in a.m.; very hot and boisterous in p.m.; incessant lightning in W. and S.W., and distant thunder at intervals in evening; wind shifted to W. at 10 p.m., followed by rain showers.
29	S.	0·127	Fine, cool, and pleasant.
30	S. and S.W. ..	0	Fine, cool, and pleasant.
31	S.E. and S.W.	0	Fine, cool, and pleasant.
..	..	0·593	

DECEMBER 1873.

Temperature of Soil—*continued*:—

Bulb 14 inches deep—Maximum, 52·0°; minimum, 44·7°; range in the month, 7·3°; mean, 48·7°.
Bulb 3 feet deep—Maximum, 67·9°; minimum, 62·8°; range in the month, 5·1°; mean, 66·2°, being 1·2° higher than the average for the preceding twelve years.
Bulb 6 feet deep—Maximum, 66·2°; minimum, 62·0°; range in the month, 4·2°; mean, 64·7°, being 1·1° higher than the average for the preceding twelve years.
Bulb 8 feet deep—Maximum, 63·1°; minimum, 59·5°; range in the month, 3·6°; mean, 61·6°, being 0·3° higher than the average for the preceding twelve years.

Solar Radiation:—

Maximum, 142·0°, on the 9th, and 140·0°, on the 8th.

Terrestrial Radiation:—

Minimum, 37·7°, on the 14th, and 38·6, on the 1st.

Humidity of Air:—

Mean, 55 (that of Saturation being represented by 100), being 10 lower than the average for the preceding fifteen years, and the lowest on record during that period.

Mean Temperature of Air at different Stations for every Month and for the Year 1873.

Months.	Portland.	Gabo Island.	Sandhurst.	Melbourne.	Stawell.	Berwick.	Cape Otway.	Ballarat.
	°	°	°	°	°	°	°	°
January ...	67·5	64·9	68·8	65·3	68·1	64·4	60·4	64·0
February ...	68·3	66·6	69·0	66·1	68·2	65·9	62·1	65·2
March... ...	67·0	63·1	64·3	62·0	63·8	61·2	59·8	61·2
April	63·8	61·8	59·5	59·7	58·8	59·2	57·0	56·7
May	58·7	57·5	53·2	55·0	53·1	55·6	54·6	51·3
June	57·4	53·7	50·9	52·2	...	52·4	54·7	48·6
July	54·7	...	46·4	46·4	...	47·8	48·6	43·7
August ...	56·4	...	49·5	51·7	...	51·2	51·4	48·2
September ...	57·7	...	52·3	53·3	...	52·2	51·5	50·9
October ...	62·0	...	58·6	59·3	...	57·4	55·9	58·2
November ...	62·5	...	61·1	57·7	...	56·7	55·2	56·1
December ...	68·4	...	72·1	67·2	69·9	65·7	60·5	67·4
Year ...	62·0	...	58·8	58·0	...	57·5	56·0	56·0

Mean Temperature of Air at different Stations for the Four Seasons and for the Year 1873.

—	Summer. Dec.–Feb.	Autumn. March–May.	Winter. June–August.	Spring. Sept.–Nov.	Year.
	°	°	°	°	°
Portland ...	66·4	63·2	56·2	60·7	61·6
Gabo Island ...	64·7	60·8	...	...	...
Sandhurst ...	67·5	59·0	48·9	57·3	58·2
Melbourne ...	64·7	58·9	50·1	56·8	57·6
Stawell ...	67·0	58·6	...	...	...
Berwick ...	63·6	58·7	50·5	55·4	57·1
Cape Otway ...	59·8	57·1	51·6	54·2	55·7
Ballarat ...	63·4	56·4	46·8	55·1	55·4

Maxima, Minima, and Range of Temperature of Air at different Stations for every Month and for the Year 1873.

Months.	Sandhurst.			Stawell.			Ballarat.			Melbourne.			Cape Otway.		
	Max.	Min.	Range.	Max.	Min.	Range.	Max.	Min.	Range.	Max.	Min.	Range.	Max.	Min.	Range.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
January	100·0	46·4	53·6	104·0	43·5	60·5	99·4	42·0	57·4	101·0	47·1	53·9	94·0	48·0	46·0
February	101·8	51·0	50·8	101·5	43·5	58·0	98·4	46·2	52·2	102·4	49·1	53·3	100·0	52·0	48·0
March	98·8	43·6	55·2	99·5	38·0	61·5	95·2	38·0	57·2	95·2	43·4	51·8	96·0	48·0	48·0
April	86·0	37·5	48·5	86·5	42·5	44·0	84·0	32·0	52·0	85·1	42·2	42·9	85·0	44·0	41·0
May	70·0	36·5	33·5	70·5	37·0	33·5	65·0	35·0	30·0	70·6	37·6	33·0	68·0	45·0	23·0
June	67·5	38·8	28·7	..	..	..	65·8	32·5	33·3	68·0	37·0	31·0	68·0	42·0	26·0
July	62·8	32·4	30·4	..	..	..	59·0	27·8	31·2	63·9	30·2	33·7	62·0	40·0	22·0
August	69·4	34·8	34·6	..	..	..	65·0	33·5	31·5	71·5	39·6	31·9	66·0	41·0	25·0
September	77·0	35·3	41·7	..	..	..	71·8	31·8	40·0	79·5	34·5	45·0	75·0	35·0	40·0
October	93·7	41·7	52·0	..	..	..	86·0	33·2	52·8	89·8	35·6	54·2	90·0	44·0	46·0
November	86·0	41·0	45·0	..	..	..	84·3	35·0	49·3	84·0	42·6	41·4	83·0	46·0	37·0
December	105·6	45·4	60·2	108·0	41·5	66·5	101·0	34·0	67·0	101·2	44·9	56·3	98·0	48·0	50·0
Extremes for the year ..	105·6	32·4	..	..	..	..	101·0	27·8	..	102·4	30·2	..	100·0	35·0	..
Greatest monthly range ..	..	..	60·2	..	..	..	..	..	67·0	..	..	56·3	..	..	50·0
Smallest monthly range ..	..	..	28·7	..	..	..	..	..	30·0	..	..	31·0	..	..	22·0
Yearly range ..	..	..	73·2	..	..	..	..	..	73·2	..	..	72·2	..	..	65·0

Means, Extremes, and Range of Temperature of Soil at different Depths, at Melbourne Observatory, for every Month and for the Year 1873.

Months.	Bulb 3 feet deep.				Bulb 6 feet deep.				Bulb 8 feet deep.			
	Max.	Min.	Mean.	Range.	Max.	Min.	Mean.	Range.	Max.	Min.	Mean.	Range.
	°	°	°	°	°	°	°	°	°	°	°	°
January	69·0	64·2	66·7	4·8	67·0	64·2	65·6	2·8	64·1	62·2	63·1	1·9
February	69·1	67·6	68·3	1·5	67·6	67·2	67·4	0·4	65·0	64·0	64·7	1·0
March	69·2	64·2	67·5	5·0	68·2	66·6	67·7	1·6	65·8	65·0	65·4	0·8
April	65·1	62·0	64·3	3·1	66·3	65·0	65·7	1·3	65·0	63·9	64·4	1·1
May	61·6	57·9	60·1	3·7	64·9	61·5	63·0	3·4	63·7	61·1	62·5	2·6
June	58·5	54·9	56·9	3·6	61·4	58·7	60·2	2·7	61·2	59·1	60·1	2·1
July	54·4	50·1	52·4	4·3	58·7	55·0	56·8	3·7	59·1	56·2	57·7	2·9
August	54·0	50·2	52·3	3·8	55·2	54·8	54·9	0·4	56·2	55·4	55·7	0·8
September	56·4	53·1	54·2	3·3	56·3	55·2	55·5	1·1	55·9	55·3	55·5	0·6
October	61·2	55·9	58·2	5·3	60·0	56·4	57·8	3·6	58·0	55·9	56·8	2·1
November	62·6	60·0	60·7	2·6	61·9	60·0	60·5	1·9	59·6	58·0	58·7	1·6
December	67·9	62·8	66·2	5·1	66·2	62·0	64·7	4·2	63·1	59·5	61·6	3·6
Means	..	..	60·6	3·8	..	..	61·6	2·3	..	..	60·5	1·8
Extremes	69·2	50·1	..	19·1	68·2	54·8	..	13·4	65·8	55·3	..	10·5

Mean Temperature of Dew-point at different Stations for every Month and for the Year 1873.

Months.	Ballarat.	Gabo Island.	Melbourne.	Cape Otway.	Portland.	Sandhurst.
	°	°	°	°	°	°
January ...	49·8	59·2	54·5	59·4	59·0	53·2
February ...	53·3	62·3	57·6	60·4	61·2	56·5
March ...	49·1	58·7	52·2	55·7	58·8	49·1
April	49·8	58·2	52·0	54·3	56·8	50·5
May	43·6	53·4	46·3	50·4	53·0	46·1
June	40·6	50·9	47·3	51·6	52·4	46·4
July	36·2	...	41·3	45·6	49·3	40·4
August ...	38·4	...	43·8	46·7	50·5	43·4
September ...	40·1	...	43·9	46·8	51·0	43·7
October ...	41·9	...	46·7	51·8	54·7	48·1
November ...	42·5	...	48·0	52·0	56·7	49·4
December ...	44·2	...	50·1	56·2	60·5	54·6
Year ...	44·1	...	48·6	52·6	55·3	48·5

Mean Temperature of Dew-point at different Stations for the Four Seasons and for the Year 1873.

Stations.	Summer. Dec.–Feb.	Autumn. March–May.	Winter. June–August.	Spring. Sept.–Nov.	Year.
	°	°	°	°	°
Portland ...	58·7	56·2	50·7	54·1	54·9
Cape Otway ...	58·6	53·5	48·0	50·2	52·6
Melbourne ...	54·7	50·2	44·1	46·2	48·8
Sandhurst ...	52·9	48·6	43·4	47·1	48·0
Ballarat ...	50·7	47·5	38·4	41·5	44·5
Gabo Island ...	59·9	56·8	...	...	...

Mean Relative Humidity at different Stations for every Month and for the Year 1873.

Months.	Ballarat.	Gabo Island.	Melbourne.	Cape Otway.	Portland.	Sandhurst.
January ...	0·60	0·82	0·69	0·96	0·74	0·58
February ...	0·66	0·86	0·75	0·94	0·78	0·64
March	0·64	0·85	0·71	0·86	0·75	0·58
April	0·78	0·88	0·76	0·91	0·78	0·72
May	0·75	0·86	0·73	0·86	0·82	0·77
June	0·74	0·90	0·84	0·89	0·83	0·85
July	0·75	...	0·83	0·89	0·82	0·79
August ...	0·69	...	0·75	0·84	0·81	0·79
September ...	0·66	...	0·71	0·84	0·78	0·73
October ...	0·55	...	0·65	0·86	0·77	0·68
November ...	0·60	...	0·70	0·89	0·81	0·66
December ...	0·43	...	0·55	0·86	0·76	0·54
Year	0·65	...	0·72	0·88	0·79	0·69

Mean Relative Humidity at different Stations for the Four Seasons and for the Year 1873.

Stations.	Summer. Dec. to Feb.	Autumn. Mar. to May.	Winter. June to Aug.	Spring. Sept. to Nov.	Year.
Cape Otway	0·95	0·88	0·87	0·86	0·89
Portland	0·75	0·78	0·82	0·79	0·78
Melbourne	0·71	0·73	0·81	0·69	0·73
Sandhurst	0·62	0·69	0·81	0·69	0·70
Ballarat	0·63	0·72	0·73	0·60	0·67
Gabo Island	0·84	0·86	...	...	...

Amount of Rainfall at different Stations for every Month and for the Year 1873.

Stations.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
Amherst	1·08	5·53	0·61	2·99	2·64	1·30	1·51	4·45	3·09	1·21	1·05	0·45	25·91
Ararat	2·08	2·52	0·70	2·04	2·01	1·84	0·93	2·48	3·21	1·71	1·78	0·15	21·45
Ballarat	2·74	2·89	1·08	3·49	1·41	2·23	1·52	2·43	3·80	3·01	2·15	0·74	27·49
Berwick	2·94	3·03	2·92	4·39	1·25	5·69	3·18	3·11	3·82	3·76	3·90	1·34	39·33
Birregurra (Ripple Vale)	1·28	3·75	1·70	3·23	3·83	2·60	3·07	3·75	4·77	3·98	2·71	1·49	36·16
Buninyong	1·77	4·08	1·91	3·03	1·45	2·59	1·92	3·66	4·47	3·53	2·09	0·82	31·32
Camperdown	0·69	1·21	2·97	2·94	3·71	1·20	4·78	1·60	4·21	2·35	1·65	0·44	27·75
Cape Otway	1·39	1·27	1·97	5·20	3·05	3·15	3·85	3·02	3·52	1·47	2·63	1·59	32 11
Daylesford	1·25	5·19	1·05	3·18	3·21	3·00	3·28	6·72	5·07	3·69	1·30	1·14	38·08
Durham Ox	2·36	2·09	0·44	1·92	1·52	1·37	..	3·23	0·52	1·74	0·84	..	16·03
Gabo Island	3·82	8·73	2·88	4·33	1·99	4·23	..	..	..	..	..	..	..
Geelong	3·06	4·21	0·86	1·77	1·64	0·78	0·89	1·66	2·43	2·06	0·84	0·52	20·72
Hamilton	0·55	1·38	2·40	2·12	3·18	1·69	1·86	2·63	4·12	1·92	2·17	0·66	24·68
Hastings	1·23	4·06	2·01	2·29	2·02	3·71	3·15	4·50	4·44	2·36	1·70	1·14	32·61
Horsham	..	..	..	..	..	..	..	..	2·05	2·77	1·10	0·11	..
Kew	2·09	3·97	1·80	2·50	0·95	2·98	1·79	2·42	3·07	3·01	2·08	0·58	27·24
Kingston	1·85	4·77	1·46	3·42	3·02	2·67	2·30	5·71	4·32	2·82	1·40	1·18	34·92
Melbourne	2·07	4·67	1·84	2·07	1·31	2·69	1·40	2·07	2·57	2·92	1·41	0·59	25·61
Piangil	..	..	..	..	..	..	..	2·50	0·81	0·71	0·93	0·68	..
Port Albert	2·38	5·03	1·60	1·63	0·48	3·01	2·32	2·69	2·87	1·86	2·07	0·48	26·42
Portland	0·40	0·81	2·40	2·72	4·89	2·21	3·38	4·10	3·71	1·89	3·11	1·15	30·77
Rokewood	1·99	3·20	0·56	2·81	1·14	1·90	1·44	1·25	2·40	2·71	1·87	0·56	21·83
Sale	3·11	8·69	0·89	2·80	0·65	2·71	1·79	1·34	1·59	1·71	8·12	0·55	33·95
Sandhurst	1·67	3·12	0·35	1·26	1·56	2·31	0·58	3·99	2·27	1·24	1·69	0·50	20·54
Schnapper Point ..	1·84	3·57	2·05	2·12	1·52	3·37	2·32	3·50	3·88	3·16	1·27	1·38	29·98
Stawell	1·90	1·91	0·69	1·25	4·17	1·64	1·35	3·76	3·55	2·06	1·06	0·10	23·44
Wahgunyah	2·63	2·18	0·09	3·16	2·21	3·74	0·70	3·62	1·79	1·40	2·05	0·65	24·22
Warrandyte	2·29	4·50	3·33	3·31	1·11	3·03	2·70	2·64	3·69	3·76	2·70	0·66	33·72
Wilson's Promontory ..	2·06	4·00	1·72	3·83	3·87	3·58	4·40	7·85	3·82	2·70	3·65	1·85	43·33
Wyndham	2·63	5·13	1·82	3·16	1·47	1·40	1·78	2·02	2·17	2·53	1·37	1·35	26·83

RAINFALL AT DIFFERENT STATIONS FOR THE FOUR SEASONS, ARRANGED IN THE ORDER OF "GREATEST YEARLY RAINFALL" FOR 1873, BEGINNING WITH 1ST DECEMBER 1872, AND ENDING WITH 30TH NOVEMBER 1873.

Names of Stations.	Summer. Dec.–Feb.	Autumn. March–May.	Winter. June–August.	Spring. Sept.–Nov.	Year.
	Inches.	Inches.	Inches.	Inches.	Inches.
Wilson's Promontory	9·08	9·42	15·83	10·17	44·50
Berwick	10·98	8·56	11·98	11·48	43·00
Daylesford	9·21	7·44	13·00	10·06	39·71
Kingston	10·34	7·90	10·68	8·54	37·46
Warrandyte ...	10·81	7·75	8·37	10·15	37·08
Hastings	9·82	6·32	11·36	8·50	36·00
Buninyong	9·70	6·39	8·17	10·09	34·35
Sale	12·43	4·34	5·84	11·42	34·03
Schnapper Point ...	10·57	5·69	9·19	8·31	33·76
Cape Otway ...	4·77	10·22	10·02	7·62	32·63
Portland	3·31	10·01	9·69	8·71	31·72
Kew	9·95	5·25	7·19	8·16	30·55
Ballarat	9·41	5·98	6·18	8·96	30·53
Wyndham	12·10	6·45	5·20	6·07	29·82
Camperdown ...	3·77	9·62	7·58	8·21	29·18
Amherst	9·85	6·24	7·26	5·35	28·70
Melbourne	10·21	5·22	6·16	6·90	28·49
Port Albert ...	9·47	3·71	8·02	6·80	28·00
Wahgunyah ...	6·81	5·46	8·06	5·24	25·57
Hamilton	3·09	7·70	6·18	8·21	25·18
Stawell	5·61	6·11	6·75	6·67	25·14
Rokewood	7·91	4·51	4·59	6·98	23·99
Ararat	6·69	4·75	5·25	6·70	23·39
Geelong	9·80	4·27	3·33	5·33	22·73
Sandhurst	6·78	3·17	6·88	5·20	22·03
Durham Ox ...	5·49	3·88	4·60	3·10	17·07

DATES OF THE OCCURRENCE OF "HOT WINDS" AT DIFFERENT STATIONS.

At Gabo Island	May 8th and 13th.
Melbourne	December 10th and 15th.
Kingston	January 29th, February 16th, March 5th, December 15th and 25th.
Portland	February 15th, March 16th, December 9th and 15th.
Stawell	February 15th and 16th.
Ararat	February 15th.
Mount Macedon ...	October 14th and 22nd, December 15th, 25th, and 28th.
Sandhurst	December 15th.
Kyneton	December 28th.

Dates on which "Frost" occurred at different Stations.

At Port Albert	May 28th, 29th and 30th, June 2nd and 27th, and July 23rd, 24th, 26th, 30th and 31st.
Kingston	May 1st and 10th, July 18th, 19th, 20th, 21st, 22nd, 23rd, 24th, 25th and 26th, and September 24th.
Portland	July 2nd, 6th, 22nd, and August 6th.
Berwick	July 22nd.
Hastings	July 20th and 27th.
Mount Macedon ...	October 14th and December 27th.
Camperdown	During the latter part of July.
Melbourne	July 18th, 22nd, 23rd, 31st, and October 9th.

Dates on which "Snow and Sleet" fell at different Stations.

At Gabo Island	June 30th.
Ballarat	August 16th and September 3rd.
Cape Otway	September 4th.
Rokewood	September 4th.
Warrandyte	September 4th and October 31st.
Kingston	Snow commenced to fall at 11 a.m. on September 4th, and fell thick all day; at 3 p.m. six inches thick on the ground, and still lying thick on the ground at 9 a.m. on the 5th, after which it gradually thawed; snow still on the hills on the 6th.

Dates of the occurrence of "Hailstorms" at different Stations.

At Melbourne	July 13th and September 4th.
Portland	July 12th and 13th, August 16th, September 4th, 13th and 14th.
Cape Otway	August 16th and 29th, September 4th and 13th.
Kingston	May 4th, September 14th and 21st.
Ballarat	September 3rd and 4th.
Berwick	September 4th and 15th, and December 26th.
Rokewood	September 14th.
Mount Macedon ...	October 17th and November 9th.
Sandhurst	September 13th.
Warrandyte	October 31st.

SOME NOTES ON WORM DISEASES IN SHEEP.

By the Secretary for Agriculture.

Worm diseases year by year appear to become more prevalent among the flocks of this and the neighboring colony of New South Wales. Country on which fluke was unknown, is by degrees becoming affected; and the losses sustained by this and other parasitic diseases appear to be ever on the increase. Various reasons are assigned for this increased mortality in our flocks. Some persons attribute it to the excessive humidity of the spring and autumn months of the past few years, others to the fencing of runs, others to the decrease in the number of saline and bitter herbs in Australian native pastures, and to the laying down of considerable tracts of country with the more succulent English grasses, and others again to over-stocking. There can be little doubt but that each of these causes has contributed its part towards this calamity—the two last-named, however, in the most marked degree. The wetness of the spring and autumn months, without question, has promoted the spread of fluke, moisture being one of the conditions essential to the existence of the parasite in its embryonic state, in which state it is found upon pastures. The fencing of runs has doubtless likewise caused this disease to extend, by compelling sheep, in times of scarcity, to depasture on spots which, if the country were open, they would not approach. The chief causes, however, for the spread of parasitic diseases among our flocks are, in my opinion, to be found in over-stocking, and the gradual disappearance of saline and bitter herbs from our native pastures which follows upon such a system. It will probably be found necessary at a future time to direct attention to the cultivation of saline and bitter plants, such as the varieties of salt bush which are indigenous to Australia, and the sheep bush which is found at the Cape. Formerly, as I am informed by Mr. W. H. Bacchus, it was customary to drive sheep to so-called "winter runs," where they remained until the approach of summer. By the adoption of this plan the pastures were not only worked to the best advantage, but disease was almost unknown among Australian flocks. In these days such a system is impracticable, if not impossible. It is well known that the injurious consequences of fluke can be stayed, if the disease cannot be absolutely cured, by removing affected animals to salt-bush country; but the travelling of fluky sheep over previously sound districts tends to spread the disease, and the practice is therefore undesirable. It will probably

be found the better plan, in years to come, to bring the salt bush to the sheep, since the sheep cannot be driven advantageously to the salt bush; and the cultivation of this and other saline and bitter plants, and their introduction into our pasture lands and due conservation by a systematic plan of grazing, will, it is likely, command the attention of flock-owners in years to come. The salt bush, as will be seen by reference to page 134, flourishes admirably under cultivation, and appears only to require protection against stock to make a handsome shrub, and judicious grazing to preserve it from becoming extinct.

A parasitic disease of a very serious character was brought before the Microscopical Society by Dr. Youl, at its meeting held on the 29th January 1874. Dr. Youl said he attached great importance to the question of this disease, as it had already killed thousands of very valuable sheep. He had undertaken the treatment of some of the sheep attacked with the disease, and, after trying the remedies usually applied to the human subject and killing several sheep, he had tried a remedy recommended by Mr. Cruikshank, which had proved eminently successful. Making a *post mortem* examination of some of the sheep, he found the first and second stomachs contained myriads of small worms. Hydatids were also present in considerable numbers, particularly under the jaw, a very unusual place for them to be found. The blood was in a very fluid state, and greatly resembled that of a person who had died from snake-bite. The land on which these sheep were depastured was of good quality, and consisted of limestone plains and basaltic country. The water was all saved in dams, and therefore liable to be contaminated. In the paddocks were a few patches of ferns, which were full of rabbits. A great peculiarity of the sheep that died from the disease was the large quantities of sand found in the stomach, there being sometimes fully 3 lbs. weight in the stomach of one sheep, among which myriads of the worms sparkled like gems. On being attacked with the disease, the sheep wasted away very rapidly, and soon died. The rabbits found on this run were attacked with the same disease, and he recommended that the covert should be destroyed, and the rabbits got rid of. He accounted for the presence of such large quantities of sand in the stomachs of the sheep to the want of salt in the pasture, which the animals attempted to supply by licking the soil. On his recommendation rock-salt had been put on the run, which the sheep licked eagerly.*

Dr. Youl was unable to state whether the disease was communicable by the rabbits to the sheep, but deemed such a course probable. Finding

* Report of the meeting of the Microscopical Society of Victoria, in the *Argus* of 30th January 1874.

that all the known remedies produced no good effect, he decided to give that recommended by Mr. Cruikshank a trial. The result was marvellous, as every sheep treated recovered. In reply to inquiries regarding the composition of the remedy recommended by Mr. Cruikshank, and the quantity administered, Dr. Youl writes:—"The quantities used for dressing sheep for worms are as follows:—

Nitre ...	...	...	...	12 ounces
Sulphur	...	...	...	50 „
Water ...	...	...	...	100 „

The nitre to be first dissolved in the water, and then the sulphur added. The dose is one (1) ounce. The mixture must be kept stirred all the time of administering it, as the sulphur is not soluble in water. The best instrument for dosing sheep with is a bullock's horn with the small point cut off; it should be put well back so as to evade the wind-pipe. The sheep should be dosed four times, at ten days intervals. They should be supplied with a mixture of salt and ten per cent. of sulphate of iron. I have received from one gentleman who has tried the remedy the most satisfactory account of its success. He tells me that he lost last year £10,000 worth of sheep; this year, under treatment, his losses have been under £10."

Mr. Alexander Bruce, chief inspector of stock in New South Wales, informs me that the disease described by Dr. Youl is well known in that colony. In a letter to me on the subject of worm diseases in sheep, he remarks:—"From what you tell me, as well as from what I have read on the subject, I have no doubt but the sulphur and nitre cure for worms in sheep is an efficacious one. I am the more inclined to this opinion from the fact that gunpowder and sulphur has been found by us to do a great deal of good. The dose is a wineglass full of the following mixture, viz:—one (1) lb. of gun or blasting powder in a gallon of water, to be given three or four times at intervals of four or five days, on an empty stomach, and to be followed by several good feeds of Liverpool salt and sulphur, in the proportion of 100 lbs. of salt to 12 lbs. of sulphur, the salt and sulphur mixture to be administered in the evening, and the sheep confined to the yards till late on the following day, to prevent them from drinking."

"Some time ago, however, a medicine was brought out by Mr. Hargan, of the Carcoar district, which the inspector reports as marvellously efficacious for both worms and fluke."

In another letter, dated 21st April 1874, Mr. Bruce writes:—"I lately received a report from one of my inspectors on a fluky worm infested country, on the different medicines tried there for worms, and

as I had been asked for information on the subject, I published those which had been found most effectual in his district, and the nitre and sulphur cure supplied by you. The following are the remedies published by Mr. Bruce (the nitre and sulphur cure has been given already at page 10):—

Linseed Oil and Turpentine.

2 drs. turps., 1 oz. linseed oil, in a thin mucilage of flour or starch, as one dose. To be given on an empty stomach, and to be repeated two or three times as necessary, at intervals of six or eight days.

Liverpool Salt and Sulphur.

To 1 cwt. Liverpool salt add 12 lbs. sulphur, mix thoroughly, and give each sheep two tablespoonfuls, either by adding water and administering it with a drenching horn three or four times, at intervals of three days, or placing the mixture dry in troughs and allowing the sheep to lick it. This, like the other medicines, to be given on an empty stomach.

Horehound.

Make as strong a decoction as possible by boiling the horehound well, and with a bullock horn give each sheep a wineglassful on an empty stomach, three or four times at intervals of three days.

Some add half-a-pint of turps. to the gallon of horehound, and others administer with it a strong dose of salt and water.

"Yesterday, too," he writes, "I was fortunate enough to meet with one of the most intelligent of our sheep breeders, and he tells me that he has proved the horehound decoction to be a thorough specific for the stomach worm. He was led to try this remedy from noticing, when drenching his sheep some two years ago for worms, with, I think he said, the sulphate of iron and salt mixture, that the sheep in a paddock where there was abundance of horehound were healthy and strong, while most of the others were badly affected."

The experience of this gentleman serves as one more proof of the beneficial action upon the system of the sheep of herbaceous plants in pastures, and again points to the necessity for introducing saline and bitter herbs into grass lands, and rigidly conserving them when cultivated.

DEVELOPMENT OF SERICULTURE, DURING EIGHTEEN MONTHS, IN VICTORIA.

By the Hon. Sec. Victorian Ladies' Sericultural Company.

Arrival of first "Grain," January 1873.—In January 1873 Mrs. Neill returned to Victoria, bringing with her some ounces of "grain" (silkworms' eggs), the produce of the only sound race of silkworms which, after twelve months' search, she was able to find in Europe. She was greatly assisted in bringing these out safely by the co-operation of the P. and O. Company, who placed an extra supply of ice on board the mail steamer for her use.

Grain, January 1873.—Grain was successfully hatched in January 1873 ; but, owing to the early frosts, and an insufficient supply of proper food, the results were small, though the cocoons made were of admirable quality, and obtained honorable mention at the Vienna Exhibition.

Formation of the V. L. S. C.—The Victorian Ladies' Sericultural Company (Limited) was formed on the 2nd June 1873.

Grain, October 1873.—October 1873, successful hatching and "education" (rearing) of grain, though in small quantities, owing still to insufficiency of food, at Corowa, Cropper's Creek, Albury, Wodonga, Chiltern, Benalla, Wangaratta, Queenscliff, and Melbourne.

Opinion of Judges in Vienna on the Silk.—Within the last few days information has been received that a sample of cocoons, the produce of this education, on being submitted in Vienna to competent judges, was pronounced to be equal to the best Italian silk in days before the disease made its appearance.

Grain, 1874.—Education, 1874. First "education" of the V. L. S. C. in Melbourne.

This education consisted, both in Melbourne and in the above-mentioned districts, of a second supply of grain sent direct from Switzerland. Owing to a delay of *ten* days in France, it reached London one day too late for the Australian mail, and was detained for the next. This unfortunate delay deprived the grain for a period of four weeks of two most important elements in its hibernation, namely, air and light. The result of the hatching, however, has shown the extraordinary tenacity of life possessed by this race of the Bombyx Morus. For specimens of the cocoons and grain, from the various districts in which

this grain has been reared, have been pronounced by Chevalier Maranucci (Italian Consul) to be of admirable quality.

First Yield.—The yield of this season's education is about 300 ounces of grain.

Chevalier Maranucci thought so highly of the grain that he has requested Mrs. Neill to let him have a small box of it to transmit to his Government, stating that he has no doubt that a large and increasing trade would be the result of its being reproduced in Italy, where the Directors of the V. L. S. C. hope that the market for their grain is already secured, bankers in Rome, Florence, and Milan, having begged to have it supplied to them in thousands of ounces.

Education, 1874 (*October*).—The approaching spring education of grain will, it is hoped, produce over 2000 ounces. These will be shipped, in November next, with the 300 already in hand, for sale, and for reproduction in Italy in the spring of 1875.

Market Price of Grain.—The present market price of grain is £1 per ounce.

Pierced Cocoons.—The floss silk and pierced cocoons will also be shipped to England to be sold. During the last few years, Mr. Leicester, of the Manningham Mills, near Bradford, has expended over £400,000 in the improvement of the machinery for combing these cocoons, and rendering the silk they yield convertible into silk fabrics, thus utilizing what were ten years ago used in France for manure.

Failure of Grain Supply in Europe.—The almost total failure of the European supply of grain, from the fact that both the silkworm and the tree from which its supply of food is drawn are diseased, has led the old world to look to the new world for its annual supply of silk grain. Silk culture has been taken up in America, to quote from an able article on this subject by Mr. S. Davenport of Adelaide, and published in the South Australia *Government Gazette*, 11th September 1873 :—

"In 1854 M. Prevost, a Frenchman, introduced the mulberry into California. The plants did well: and four years after he imported eggs from China and France. His success attracting the attention of Government, the Legislature, in 1866, passed an '*Act for the Encouragement of Silk Culture*,' which offered a reward of 250 dollars for each plantation of 5000 two-year-old mulberries, and of 300 dollars for 1000 silk cocoons (*Baldwin Silk Supply Journal*), produced within four years. The result was that, in 1869, there were upwards of 4,000,000 trees in the State. * * * Near Sacramento upwards of 700,000 were planted on over 100 acres, and here were two cocooneries. * * * They contained upwards of 3,000,000 worms."

Japanese Grain.—Information has recently been received of two large consignments of grain sent from Japan to Europe. One consisted

of $9\frac{1}{2}$ tons of eggs, and was valued at 2,000,000 dollars ; the other was not so large.

Returns.—The returns calculated from known data are as follows :— 20 trees, 5 years old, should feed one ounce of grain. One ounce of grain should in one education produce 120 ounces.

Five hundred mulberry trees may be planted on one acre of land.

The Mulberry.—The mulberry thrives admirably in Victoria, where the climate is well adapted for its culture, and does not require a rich soil to reach great perfection of growth and foliage. Thus the supply of food may be reckoned upon as almost unlimited.

Action taken in Sericulture in neighboring Colonies.—Queensland, South Australia, New South Wales, and Western Australia, are all initiating this new industry, particularly New South Wales, whose Government is affording Mr. Brady (a Sericulturist) the most liberal personal assistance towards furthering the cause of sericulture in that colony.

ARTAMUS SUPERCILIOSUS (GOULD)—WHITE-EYEBROWED WOOD SWALLOW.

By the Secretary for Agriculture.

The past summer was marked by the appearance in great numbers of the above-named bird, known to Victorians as the white-eye or summer bird ; and its great use as an insect destroyer, saving, as it frequently does, whole crops from much damage, if not annihilation, has rendered it expedient to place its visitation on record, and to give a woodcut of the bird itself.

The Artamus superciliosus is strictly migratory. In the neighborhood of Melbourne it makes its appearance generally from the beginning to the middle of December, remains during the breeding season, and departs from the beginning to the middle of February. According to Gould, there is no species of Artamus yet discovered to which the present yields the palm, either for elegance of form, or for the beauty and variety of its plumage ; the only known species with which it could be confounded is the Artamus rufiventer, an Indian bird, with the

breast similarly marked, but which is entirely destitute of the superciliary stripe of white which has suggested the specific name. In this character, and in the rich chestnut coloring of the breast, it differs from every member of its tribe in Australia.*

Gould speaks of this bird as being shy and difficult of approach, but such certainly is not characteristic of it in the southern portions of Victoria; on the contrary, it is particularly tame, and when a stranger passes in the proximity of its nest, or of its young when fledged and learning to fly, will sit perched upon a neighboring branch or fly chirping from twig to twig.

It builds its nest in the most exposed situations—oftentimes in a low bush, at the very door of a house—but at times also in the branches and forks of trees. The nest is somewhat difficult of detection, being

ARTAMUS SUPERCILIOSUS (Gould)—WHITE-EYEBROWED WOOD SWALLOW.

composed of small twigs loosely placed together and lined with fibrous roots, and contains two eggs, which resemble very closely those of the Australian lark. The ground color is dull buff, spotted with brown, forming a zone near the larger end.

The Artamus superciliosus is strictly insectivorous, feeding both on the larva and the perfect insect. It may be observed perched upon

* Gould: *Birds of Australia*, vol. ii.

low-growing shrubs, and also the topmost branches of high trees, from which it sallies forth in pursuit of insects, and to which it again returns. In my report of 1873, at page 70, I observed that Mr. Davey, a gentleman who resides in Stawell, had informed me that, during 1870–1 and 1871–2, the locusts in the Wimmera district were followed by a flock of birds resembling in form and flight the swallow, but being of nearly twice the size; and he remarked that they were very active in destroying the locusts. Professor McCoy informed me at the time that the bird is scientifically known by the name Artamus superciliosus. In the month of December of last year, as I am informed by Mr. Bailey, of Broadmeadows, a patch of flax that he had planted upon his farm was suddenly attacked by an immense horde of caterpillars, which threatened to devour the entire crop. A flock of these birds happened to visit his farm, and, before the caterpillars had time to do much harm, cleared the crop of them. About the same time, the vineyard of Mr. James Banks, at Flemington, was similarly attacked, and it likewise was saved from destruction, and Mr. Banks from loss, by the appearance on the spot of the flock of Artamus superciliosus.

The nests of these birds are robbed by boys unsparingly, a practice which it should be the interest of everyone to check.

Gould describes this bird as follows :—

"The male has the lores space surrounding the eye, and the ear-coverts, deep black; chin greyish-black, passing into blackish-grey on the chest; crown of the head greyish-black; over each eye a pure white stripe commencing in a point, and gradually becoming wider or spatulate in form as it proceeds towards the occiput; all the upper surface, wings, and tail fuliginous grey, which is lightest on the rump and tail; all the tail feathers tipped with white, except the outer web of the lateral feather, which is grey; under surface of the wing pure white; all the under surface rich deep chestnut; irides nearly black; bill light-blue at the base, black at the tip; feet dark lead color.

"The female has a similar distribution of coloring, but differs from her mate in the following particulars :—Lores and a ring round the eye jet black; only an indication of the superciliary stripe; throat grey; tail not so distinctly tipped with white; under-surface light chestnut grey."

The engraving represents the male bird one-half natural size, and is copied from the illustration given in Gould's "*Birds of Australia*," vol. ii., Plate XXXII.

UPON THE STATE OF AGRICULTURE IN THE BURRUMBEET, DEAN, AND SMEATON DISTRICTS.

By Mr. W. E. Ivey.

The following paper was suggested upon travelling through this portion of Victoria in connexion with an inspection of the Bullarook Forest, and does not profess to go deeply into the question of agriculture in these districts, but rather gives the points that would strike a visitor deeply interested in agricultural pursuits. The journey was made through the Pentland Hills country, and Ballan, to Burrumbeet, Dean, and Smeaton, the whole of which districts are taken together.

The great extent of this country—with the exception of a patch of silurian here and there—is of the later volcanic period, and may be described as of a somewhat similar character throughout, sufficiently so for a like system of management, and of the applicability throughout of notes taken in any particular portion, though cultivation and climate, combined with difference in the quality of the soil—which seem to depend upon the proximity or otherwise to the higher hills—cause doubtless much diversity in the appearance of different parts.

First, Cultivation.—In all parts the difference between good and bad management is striking. Sorrel, with the Australian plants known locally as iron-weed, mother maum, a species of helichrysum, and in some places the inevitable thistle, take full possession of certain fields side by side with others in better hands, which present to the eye fine pasturage of rye-grass and white clover, or equally good crops of corn, peas, red clover, or lucerne, the quality of these speaking volumes in many places upon the question of farm management, and the value of the soil and its capabilities when properly treated.

On the Pentland Hills the thistle seems to have full possession of very large areas. Men are employed with the scythe; but this can only be useful in preventing seeding. These lands have all been "exhausted" by continued cropping, and yet the fine pieces of white clover to be seen here and there show that it is only through inattention to the ordinary requirements of land, neglecting even to give rest and change by some slight attempt at rotation of crops or otherwise, that this fine portion of the country presents such a sorry appearance. Two other plants than those above mentioned may be observed here in great force, viz., the wild camomile and the wall barley grass.

In the Burrumbeet district the same features may be observed, and, including Learmonth and Dean, the extremes of good and bad management may be met with, often in adjoining fields. No finer pieces of red clover could be found in Great Britain, and no heavier crops of peas; whilst often alongside these, land of equal quality is a waste of sorrel or waving with the white foliage of the helichrysum, whilst often in a crop of sown corn either sorrel or the iron-weed strive for mastery with the unfortunate cereal, leaving but little room for doubt as to the ultimate result.

From all accounts, the last three wet seasons have been comparatively more or less unfavorable for cereals on the more elevated portions of these districts. This, combined with the exhaustion of large areas by excessive long-continued cropping with white straw crops, has caused the better class of farmers to turn their attention more to the growth of grass. Truly in many cases, even where cereals have at last refused to return a paying yield, it has been found that a crop—or even two—of peas may be profitably taken, whilst on the more newly broken soil first-class returns of this pulse are obtained; but grazing seems to be that branch of agriculture for which these soils are best suited, at least under present circumstances, or rather conditions. Many of the larger and the better farmers have accepted the position, the more gladly on account of the yearly increasing complications in connexion with the labor question; and in numerous instances there is but little to be desired in the quality of such of the pasture lands as have been properly laid down, whilst the greater advantages derived therefrom, in enabling the proper feeding of stock, show their mark in the improved values of the flocks and herds depastured thereon.

As yet these conditions are not universal. As has been said, large areas are in the possession of sorrel and other weeds—sorrel especially seems to frighten many who year by year have found it growing up with their corn, and overpowering it. To these the sorrel is a dreadful pest. But if they would but use their land after the manner of their seeming more intelligent neighbors, sorrel would not be the trouble it now is to them. Rather should they praise this weed, as preventing them growing corn crop after corn crop, to the certain destruction of the productive powers of their soil. The remedy for this pest is simple and effective—grow grass—give the land a rest. Sorrel readily gives way to the clovers, if the land be fairly treated before sowing. In some cases the white clover seems to be choking out the sorrel, even where the latter has had full possession, but there can be no doubt this valuable plant should be assisted. All land infested with any of these weeds

should be broken up dry in the early summer. Facility of ploughing should not be considered, but extra horse-power expended to secure this desideratum, the ground being left as rough as possible, that the heat of the summer sun may get through it and kill as much as possible of the rhizomes of the sorrel. The amount of cultivation throughout the summer would be a question of expediency and expense; but even breaking down with the harrows after the first autumn rains would, after a very dry summer, be sufficient to form a seed-bed for the clover, the point being to destroy as much as possible of the sorrel by exposure during the hot weather, so that the clover may get as firm a hold as possible the first season. The sorrel remaining is sooner or later choked out, depending upon the success of the summer operations in destroying a greater or less proportion of that weed. In cases where annuals are likely to come up very thick, and retard the growth of the clover, it would be as well, after harrowing well down after the early autumn rains, to let the land remain for the germination of the seeds of these annuals to take place, then to plough with a shallow furrow, and sow the clover, thus giving the plant a fair start. There need be no fear of it afterwards retaining its hold.

The management of pasture land in this neighborhood seems not to be thought of great importance. The absence generally of any such practices as are rigidly carried out in older countries is probably the result of the existence in the olden days of almost unlimited pasture lands; but this must be remedied now that population is denser, areas owned by individuals much smaller, and more meat and wool necessarily raised on each acre to support the cultivators. Therefore, where corn-growing has succumbed to grazing on these restricted areas, as much care should be bestowed upon the grass land as was heretofore upon the same lands when under corn. The question of stock is of course here a most important one, but the raising of food for them of still greater importance. To carry the largest weight of stock per acre we must look very much to breed, but more to the treatment of our soil. Artificial manuring and artificial feeding are both here out of the question; but a modification of the English practice of hurdling sheep would vastly increase the stock-carrying power of many farms. It is too much the practice in these districts to lightly stock at once the whole grass land of the farm. The stock day by day run over the same land; they tire of it; they waste much; they have choice places where the herbage is sweeter, and which they graze day after day, biting off every fresh blade as soon as it appears, preventing a strong growth in these places, whilst in other parts, growing, perhaps, grass not so sweet

to their taste, a coarse growth exists through neglect in favor of choice spots.

On all these grazing farms the paddocks should be numerous, that the stock should get frequent change, and the grass land absolute rest at times. These paddocks should be heavily stocked in rotation, the stock only kept in each piece as short a time as possible, and when grazed shut up free from all stock until there is again a really good bite. It is then again fresh to the stock, and the grass itself has all of it recovered from its first grazing, and has had time to strengthen its roots by the larger surface of its leaves during a period of rest, the roots drawing nourishment from greater depths, the result being a healthier and stronger plant and greater productiveness, with no more exhaustion of the soil than if it grew a more weakly plant drawing its sustenance from near the surface.

To ensure these fields being well and evenly grazed, and to economise food, besides the necessity, in fattening and in rearing young stock, of always keeping them on good grass, the separation of these from the breeding stock should be more generally attended to than is the custom; in the case of sheep, the fattening stock, lambs, &c., having always the first run over the fresh paddocks, the ewe flock following them into the one they have just quitted. The ewes not having had the pick of the fresh grass, are not so fastidious, and being kept somewhat short, do not pick the grass much, but feed more or less evenly, and they may be removed when the field has a shorn appearance, care being taken that the grasses are not injured by too close feeding. The paddocks thus grazed should be then shut up in succession, and no stock whatever put on until fit again for use.

The size of the paddocks would to some extent depend upon the size of the farm and nature of the stock, but cannot well be too small where heavy sheep are bred and fattened. The item fencing would prevent error in that direction, though a daily change for fattening and young sheep would, if practicable, be an advantage. This is, of course, out of the question at present, but should be approached as nearly as possible. Another point to take into consideration is the species of grasses to be sown. Red clover and cow-grass give a later bite than the white clover, but are not fit so early in spring. Again, the cocksfoot is also a later grass than the ryegrass, and is worthy of more notice than is in Victoria bestowed upon it. If properly stocked, it does not get tussocky and coarse as it is otherwise apt to do; it is better suited to a worn-out soil than ryegrass, and especially to the somewhat lighter class of soils; it will withstand very heavy stocking; is certainly

not liked quite so well by stock as ryegrass, but is, in parts of New Zealand, the prevailing grass on the volcanic loams, carrying an immense weight of stock per acre. By a judicious selection and sowing of these earlier and later grasses, and proper management in the feeding of them off, a very much larger quantity of stock could be carried on almost the whole of these volcanic soils.

As to the breed of sheep best suited to this neighborhood, that cannot be yet decided. If properly managed, this is a long-wool country undoubtedly—admitting the long-wool to be the most profitable breed where the country is adapted to carry it—but whether any of the pure English breeds of long-wools would thrive in case of a dry season or two seems doubtful. The Lincoln is coming somewhat into favor, and is a most valuable sheep, and suitable in such seasons as the present; but it is questionable whether a flock of good quality could be kept up to the mark year after year. The conditions under which that sheep is bred in the fens of Lincolnshire, with its colza crop and artificial food, and those to be found here, are so different, that a modification of the present sheep must be expected to take place to make the animal more suited to the climate and food of its new home. The cotswold would seem to be better suited, but the sheep of the future for these pastures is yet to be bred: perhaps a cross, perhaps a modification of an existing breed, that one which most readily adapts itself to the altered conditions of its surroundings.

The above remarks on sheep stock apply almost equally to cattle. Whether sheep or cattle be the more profitable, being a question of experience; but whichever be adopted, with the present prices of meat and wool, grazing should prove a more profitable occupation than growing corn on the bulk of the land of each farm in this district, corn occupying a secondary position, being taken at times, but only where the land is in such heart as to ensure such a crop as will give a good return for the trouble and cost expended upon it.

FLAX AND FLAX MACHINERY.

By the Secretary for Agriculture.

Flax culture, as was anticipated in my report for 1873, at page 4, has not been attended with success. In the month of August of last year, seed sufficient to sow one acre of land was supplied to twenty-six persons in various parts of the country; from none, however, has a strictly favorable report been received. The failure in the crop is generally attributed to the excessive dryness of the spring months, and the subsequent frequency of hot winds. For example, Mr. Boadle, Manager of the Experimental Farm of the Smeaton Agricultural Society, after mentioning that sowing was delayed until the 24th of September, owing to the heavy rains which fell during that month, writes—"The seed, which was very clean and of excellent quality, came up admirably, and the crop continued to grow luxuriantly until it reached a height of about 12 inches, at the beginning of December, when it came to a standstill for want of rain. I attribute the failure of the crop—for failure I cannot help but call it—to the extremely hot and dry summer we have had." Mr. Bailey, writing from Greenvale, near Broadmeadows, states—"The seed supplied to me in August 1873 was sown during the same month, on a dark sandy loam, and the crop was pulled in December. The season was too dry for flax. To grow well, this crop requires a moist spring, such as it gets in England, whereas ours was an exceptionally dry one; and the result has been short fibre." Mr. David Cathcart, of Hesket, writes:—"The flax grew rather short, owing to the excessive drought we experienced so early in the season, which caused it to ripen sooner than it would have done had the ground been a little more moist. It averaged from two feet six inches to three feet in length." Numerous reports, written in the same strain, might be quoted; but it is needless to multiply evidence as to the failure of last season's flax crop.

Climatic influences are not the only obstacles to the profitable cultivation of flax in Victoria. The scarcity of proper water for steeping in many instances, and its absence in others, together with the difficulties attending the harvesting and after-treatment of the crop, owing to the deficiency and high price of labor, render the profitable production of flax precarious in a high degree. Many persons, however, still think that the cultivation of flax may be introduced advantageously into Victorian agriculture, if the labor difficulty can be overcome.

Regarding the proper time to sow flax, one person writes—"If I were going to grow flax again, I should sow it at the latter end of May, as a few plants I had that were self-sown stood the frost and grew through the winter, and ripened in December. They were double the height of the crop sown in September."

Of the twenty-six persons to whom seed was supplied, seven only forwarded samples to the Department of Agriculture for competition. Six of these sent in their samples by the date specified, viz., the 8th May, whereas the seventh, Mr. James Hagan, of Dunolly, did not forward his until the 30th May, consequently his sample was not permitted to compete, and could not have been even had it been received prior to the other samples having been reported upon by the judges.

The six samples above referred to were submitted to judges for examination and report on the 21st May. The following are the instructions given to the judges, and the judges' report:—

Directions for the Guidance of the Flax-Judges.

The gentlemen who have kindly consented, in response to the invitation of this department, to adjudicate on the samples of flax forwarded for competition, by persons in different parts of the colony, and grown from seed supplied to them by the Department of Agriculture in August 1873, are requested to observe and report on the following matters:—

1. The general condition, as regards quality, of the samples forwarded.

2. The dressing of the samples sent in, pointing out any shortcomings or any excellencies which may present themselves in individual instances. (The Regulations only require the samples to be dressed sufficiently finely for the purposes of the manufacture of rope, bagging, and twines; *vide* subdivision 4 of clause 3 of Regulations appended.)

3. To classify the samples in order of merit, and to recommend what sums, if any, shall be granted as bonuses, and to whom.

The judges are also requested to report their decisions in writing, and to embody in such report their individual opinions regarding flax-culture as a desirable industry for encouragement in this colony, basing such opinions upon the insight which the examination of the samples herewith submitted have afforded, and their former experience of the growth of this staple in Victoria; and to state whether, in their opinions, the cultivation of flax could be rendered both more profitable and more desirable of encouragement by the removal of the labor difficulties which now attend the harvesting and after-treatment of the crop, by the invention of machinery to supersede hand labor in these operations.

The samples are numbered consecutively, from 1–6. In referring to any sample, the judges will be good enough to refer to its number, appended.

The numbers on samples correspond with numbers elsewhere preserved, which numbers have the names of the competitors, alphabetically arranged, appended to

them. These last-named numbers and appendices will be submitted for the information of the judges, when they shall have reported on the samples placed before them.

A. R. WALLIS,
Secretary for Agriculture.

14 | 5 | 74.

Department of Agriculture,
Melbourne, 21st May 1874.

Sir,

We, the judges appointed by the Honorable the Minister of Lands and Agriculture to examine and report on six samples of flax forwarded to the Department of Agriculture for competition, and grown from seed supplied by that department in August 1873, have the honor to report on our deliberations as follows :—

1. As regards the general quality of the samples submitted, we desire to state that we consider three of the six creditable to the growers, one fair, and two inferior.

2. Concerning the dressing of the samples, we consider No. 2 to be fully up to the required standard ; No. 5 is the next best, but falls short of the necessary standard, too much woody fibre having been left in the sample. The same may be said of No. 4 as of No. 5, excepting that No. 4 falls still further below the required standard.

3. Numbers 2 and 5 we consider entitled to equal awards, the one (2) on the score of superior dressing and general get-up, the other (5) on account of the strength and quality of the fibre, though slightly deficient in point of dressing. Excepting this drawback in No. 5, both of these samples are highly creditable to the producers. We award second place to No. 4, which for length, color, and strength of fibre, is equal, if not superior, to any other sample ; but, for the want of proper manipulation, we are necessitated to give it only a second place ; at the same time, we desire to express an opinion that the land upon which this sample was grown is admirably adapted for the production of flax. Of numbers 1, 3, and 6, little that is favorable can be reported. Apart from deficiency of get-up, the fibre of all these samples was found to be wanting in toughness, and consequently of low marketable value. A good deal of trouble has evidently been taken by the grower of No. 3 in the preparation of his sample, but the fibre is totally deficient in strength. The judges regret that they can offer no remarks favorable in the case of No. 1.

As regards the bonuses to be awarded, we would beg to recommend £50 each to Nos. 2 and 5, and £30 to No. 4.

Concerning the value of the samples, Nos. 2 and 5 are worth about £50 per ton in the Melbourne market, No. 4 about £30 per ton, Nos. 1, 3, and 6 are estimated at the value of jute, viz., from £15, downwards.

Judging from the quality of the fibres submitted to us for examination, we are of opinion that, if such appliances could be secured as would lessen the cost of production so as to leave a profit to the grower, it is quite evident that we possess both the soil and climate suitable for the production of a high-class fibre.

We have, &c.,
JAMES MILLER,
JOSIAH MITCHELL,
FREDERICK SEARCH.

A. R. Wallis, Esq., Secretary for Agriculture.

NAMES AND CORRESPONDING NUMBERS OF COMPETITORS FOR FLAX BONUSES.

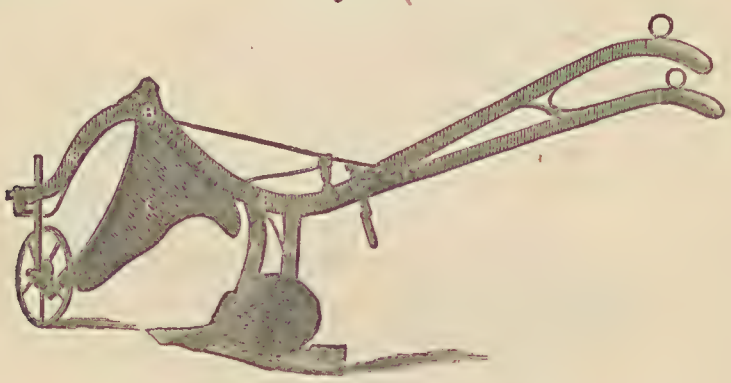
No. 1. Charles Bailey, Greenvale, Broadmeadows.
No. 2. D. Cathcart, Hesket.
No. 3. J. Dowey, Romsey.
No. 4. T. Longmuir, Hit-or-Miss.
No. 5. Donald McAndrew, Queenscliff.
No. 6. T. Skelton, Mount Clear, Ballarat.

NOTE.—A seventh sample was received from Mr. James Hagan, of Dunolly, after the report of the judges had been sent in, which has been pronounced inferior to either of the prize samples, though superior to the remainder that competed.

FLAX MACHINERY.

With a view to remove, as far as practicable, the difficulties which beset the harvesting of the flax crop, this department has resolved—in reply to the invitation of the Adelaide Chamber of Manufactures—to offer, in conjunction with that body and the Royal Agricultural and Horticultural Society of South Australia, substantial premiums for the invention of machinery to lessen the cost of gathering in the crop. And in order to place Victorian competitors, should any be forthcoming, in possession of all that has been done in this direction in the neighboring colony of South Australia, woodcuts and descriptions of two ploughs, made after models presented to the Adelaide Chamber of Manufactures by Mr. W. F. Gray, are appended. The manufacture of a plough after the first of these models was entrusted to Mr. Illman, of Sellick's Hill, South Australia.

Fig. 36.



GRAY'S FLAX-PULLING PLOUGH.

This implement is described by Mr. J. Fairfax Conigrave, Secretary to the Adelaide Chamber of Manufactures, as follows :—

"The body of the plough, AA, is two feet high. The beam, BBB, is curved, to give room for the flax to pass under it. The divider, C, is armed with a sharp front edge, to cut the flax, the seed-bolls of which interlace very much. It is supposed to enter the crop, separating a row of it as wide as the plough will move—twelve inches.

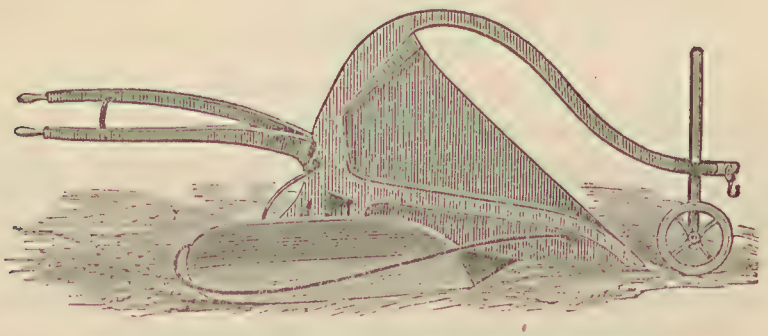
"The share and mould-board of this plough are of the ordinary kind. The beam has a double crank in it, to allow the pull to be on the outside of the crop, whilst the other parts are in and under the crop."

This plough was submitted to public trial at Willunga on the 28th November 1873, and the following is extracted from the report of the sub-committee appointed to report on the trial:—

"Your sub-committee beg to report that, on Friday the 28th November, they proceeded to Willunga, in accordance with the resolution of the standing committee, to be present at the trial of the flax-pulling plough which your Chamber had instructed Mr. Illman, of Sellick's Hill, to make after the model presented to your Chamber by Mr. W. F. Gray.

"From the result of the first trial, upon a piece of flax crop in the locality of Sellick's Hill, it was confidently expected that the trial of Friday would have been more successful than it was; but it is much to be regretted that the invention had not been tried upon similar grounds on the occasion of the public trial to that upon which it was at first tried. Although not on this occasion so successful as your committee had anticipated, the flax-pulling plough may be made so by the addition of improvements which were suggested by this trial. Your committee feel that a really useful implement has been produced in Mr. Gray's model, and regret that the funds of the Chamber will not at present allow its further development. However this may be, your committee feel confident that much good will result in calling together so many as it did to study together the possibility of contending by means of machinery with the cost of manual labor, which is, no doubt, the greatest obstacle that the flax-growing industry encounters. Your committee feel assured that any one endeavoring to facilitate the labor of a flax-field will meet with infinitely more impediments than in other crops, particularly from the interlacing of the seed-bolls with each other, as also in separating the straw from the soil, which in some crops clods them to their great detriment. But when it is remembered that many improvements were invented upon the now universal reaping and mowing machines, your committee have full warranty in confidently anticipating that mechanical ingenuity will soon devise some method for facilitating the growing of the flax crop."—*South Australian Register*, 12th January 1874.

Fig. 37.



GRAY'S IMPROVED FLAX-PULLING PLOUGH.

Fig. 37 represents an improved flax-pulling plough, which embodies the alterations suggested at the trial of the plough described above. "The faults in this plough," writes Mr. Conigrave, "were that the

straw gathered across the body, under the divider, and the mould-board turned the sod over and buried too much of the straw. In the improved model these defects are remedied; and one horse—a good steady one—can draw the plough with great ease. The shape of the beam is altered, and the divider extends from the beam into the ground the same depth as the share, so as to make a complete separation between the standing crop and the piece to be removed. The toe would act as a coulter, and the front edge would be sharp. It is thought this will obviate the choking which was noticeable when the first plough was tested. Instead, also, of the convex mould-board, a long and nearly flat one has been substituted. This will be capable of removing twelve inches of soil—just pushing it on one side, and clearing a sufficient space for the horse to travel down in the next bout, and thus enabling the horse work to be finished at once. The gathering might be left for days without harm. The iron rod over the mould-board is intended to lay down the flax after it has been loosened by the plough, in readiness to be taken up by the binders."

It has been decided to offer three prizes of £150, £100, and £50 respectively at the projected intercolonial competition of flax-harvesting machinery, and to hold an equal number of trials in each of the contributing colonies. Intending competitors must lodge their entries, together with an entrance-fee of 10s. 6d., with the honorary secretary, Mr. J. F. Conigrave, 14 Register Chambers, Adelaide, on or before Saturday the 15th August 1874. The trials will take place about the end of October in South Australia and the end of November in Victoria, at times and places to be hereafter notified.

The following are the conditions of competition, copies of which may be obtained on application to the honorary secretary, Mr. J. F. Conigrave, Adelaide, or to the Secretary for Agriculture, Melbourne:—

INTERCOLONIAL COMPETITION OF FLAX-HARVESTING MACHINERY.

Conditions of Competition.

1. It is indispensable that the machine be simple of construction, and that it combine strength and durability with lightness of draught; also that it take the flax out of the ground, and not simply cut it off, and deliver the flax without crossing or entangling the stalks, and with the roots even.
2. The machine must be so constructed as to render it capable of being worked by any farm laborer of ordinary intelligence.
3. Competitors must lodge their entries in writing with the honorary secretary, Mr. J. F. Conigrave, No. 14 Register Chambers, Adelaide, together with an entrance-fee of Ten shillings and sixpence, which shall be deemed forfeited should any competitor fail to comply with all the conditions of competition.

4. Persons entering machines for competition must exhibit and submit the same for trial in both colonies; the freight on such machines to be borne by the Department of Agriculture in Victoria and the Adelaide Chamber of Manufactures and Royal Agricultural and Horticultural Society of South Australia, unless the judges shall report to the stewards that any implement has not sufficient merit to justify the expense of forwarding it to the second competition.
5. The prizes shall be as follow, viz. :—
   1st prize, £150; 2nd do., £100; and 3rd do., £50; but no third prize shall be awarded unless six machines compete.
6. One trial, which shall extend over one or more days as circumstances may demand, shall be held in each colony, upon dates and in localities to be notified hereafter.
7. Four judges shall be appointed, two from and to represent each colony; and these four judges shall, before the first trial, choose a referee, to whom disputes as to the merits of any machine shall be referred; the said referee to be present at the trials in each colony. And the ruling of any three of the abovementioned persons shall be deemed final.
8. The judges shall have power to order the trial of the machines to be made in any way which they may deem fit, and may refuse to award any one or all of the proposed prizes should they rule that any one or no machine be worthy.
9. Five stewards shall be appointed in each colony to conduct the business connected with the trials in such colony, and to hear and decide any disputes which may arise; and one of the said stewards in the event of the absence of the honorary secretary shall act in his stead.
10. At the meetings of stewards three shall form a quorum.
11. Protests or complaints must be made in writing, and lodged with the honorary secretary, or one of the stewards, together with a deposit of £2 2s., on the day and at the time of trial; and every such deposit or complaint shall be heard and decided before three or more of the stewards, whose ruling shall be final.
12. In the event of the said stewards finding that any protest or complaint so made be, in their opinion, trivial or without foundation, the person making such protest or complaint shall forfeit his deposit of £2 2s.

Breaking and Scutching Machinery.

The want of machinery to cheapen production is not felt alone in the operation of harvesting. The after-treatment of the flax crop requires much careful manipulation, which, so long as it has to be performed by hand, will render the cultivation of flax in Victoria unremunerative, or only sparingly profitable. A machine to supersede manual labor in these operations has already been invented and manufactured by a leading Melbourne firm. A description of this machine is given in the Report of the Department of Agriculture, 1873, at page 99.

Upwards of twenty years ago, Chevalier Claussen—whose efforts to elevate the flax industry by devising means by which the fibre could be

placed more cheaply upon the market, and thus be brought more closely into competition with cotton, are generally well known—recognised the necessity for a machine which should combine the three distinct actions of crushing, beating, and rubbing, so that, without injury to the fibre, a large percentage of wood might be removed before steeping; and he set himself to work to perfect his idea. Claussen's labors resulted in the production of a machine, a model of which was exhibited in the Great Exhibition of 1851. His invention, however, met with much opposition; and, unfortunately, owing to the parts having been manufactured without the personal supervision of Claussen, the machine was found, in practice, to be too ponderous for the farmer, as well as defective in construction. Mr. Frederick Moore subsequently constructed for Claussen a more portable and perfect machine, by means of which unsteeped straw could be divested of a large percentage of its woody structure, without injury to the fibre. Mr. Moore's machine met with general approval, and, but for the time being inopportune—cotton just then having been largely imported into European markets—it would doubtless have been a financial success. With a view to revive Claussen's invention, and to place machinists in possession of the facts connected with it, the following description, with woodcuts, of Mr. Moore's machine, first published more than twenty years ago, is given *:—

"Flax manufacturers are in the habit of using 'breakers' for the purpose of crushing the straw after steeping. Such machines, however, are not fitted for the objects sought in the Claussen process; as, in all cases, the flax operated on by them requires to be scutched afterwards for the removal of the wood.

"If straw in its raw state be passed through what is termed a 'breaker,' the cylindrical form of the harl-tube would be destroyed, and the boon would be flattened and partially broken; but scarcely an atom of the wood would be actually removed. Such a machine, therefore, would not serve the farmer, by enabling him to return to the land any portion of his crop, nor would it diminish the weight of the produce to be transported.

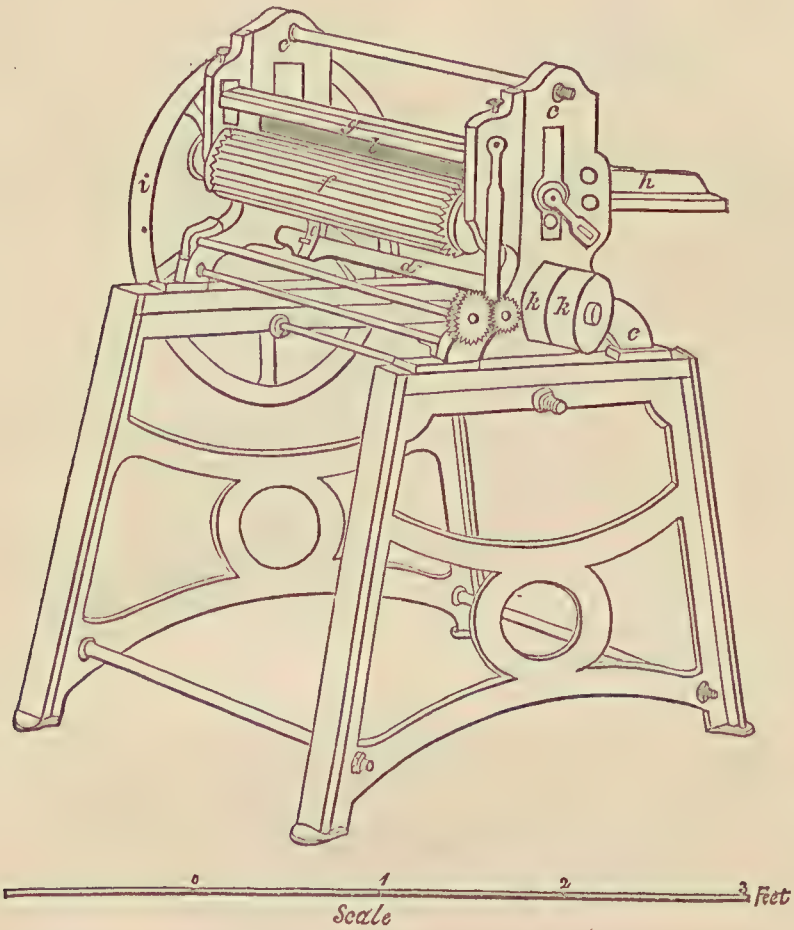
"Breakers at present consist of a number of fluted rollers, between which the flax straw is passed after steeping.

"It is evident, that to remove the wood of raw straw something more than mere crushing by fluted rollers is required; and therefore Chevalier Claussen, at an early period of his invention, seems to have directed his attention to this point. In the Great Exhibition of 1851 he exhibited a model of a flax straw-breaker. His object in the construction of this machine being to obtain the three distinct actions of crushing, beating, and rubbing, so that, without injury to the fibre, as large an amount as possible of wood might be removed before steeping; but the apparatus having been manufactured at a considerable distance, and without the personal supervision of Claussen, it was found in practice to be too ponderous for the farmer as well as imperfect in its construction and material. Mr. Moore,

* Claussen's Flax Process, by Dr. Ryan, LL.D., London, 1852.

therefore, has constructed for Claussen a much more perfect and portable machine, by means of which dried unsteeped straw is denuded of 50 per cent. of its wood without the slightest injury to the fibre.

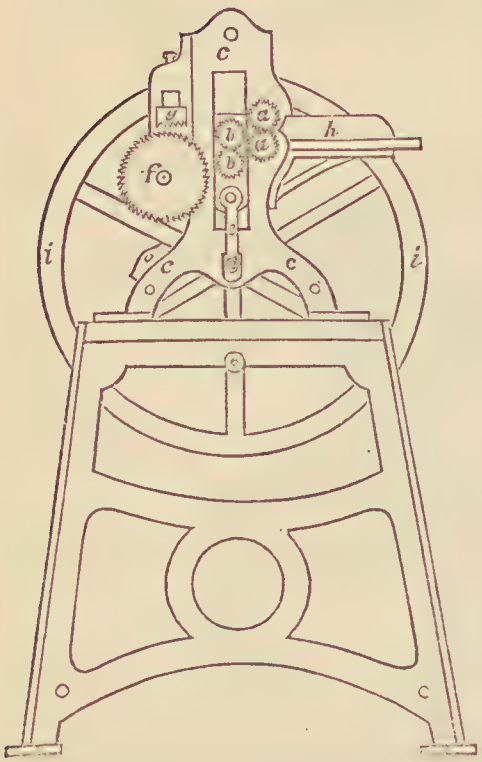
Fig. 38.



CLAUSSEN'S FLAX STRAW-BREAKER IMPROVED BY MR. MOORE.

"The operations of this machine commence with placing the flax on the feed-board *h* and offering it to the drawing-rollers *a a*. The flax having passed an inch or two through these rollers is seized by the oscillating fluted rollers *b b*; which are moved up and down in the framing *c* by the crank *d* and connecting rods *e e*; the superiority of this motion being that the wood or boon is as completely broken as though rubbed out by the hand, while at the same time the fibre remains perfectly uninjured through its entire length whatever that may be. The bott-hammer, so universally employed in Belgium, has also, by a mechanical contrivance, been adapted to the machine. The parts consist of a toothed wooden roller *f*, over which the broken flax is delivered after leaving the oscillating rollers *b b*. The flax is struck while on the roller *f* by a toothed wooden hammer *g*, which not only divests the flax of any remaining boon, but materially preserves the parallelism of the fibres. In the machine which Claussen exhibited in 1851 the break is brought down by the steadily increasing but unyielding pressure of a heavy crank; consequently any deviation in feeding, however slight, produces mischief.

Fig. 39.



CLAUSSEN'S FLAX STRAW-BREAKER IMPROVED BY MR. MOORE.

"The mechanical bott-hammer, however, in Figs. 38 and 39, being raised by two small quoins, is allowed to drop on the flax by its own weight alone, such weight being immediately raised again; therefore, be the quantity ever so small, even to a single layer, the straw is as equally struck or broken as any larger amount, while an increased quantity, no matter how thickly spread, is, by such mechanical adaptation of the bott-hammer, completely prevented from being cut through or in any way injured.

"Another advantage peculiar to the oscillating-roller machine is, that none of the rollers are weighted; the top of one tooth is also prevented from touching the bottom of any other. *h* is the feed-board; *i* is the fly-wheel; *k k* the driving-riggers or pulleys.

"As this machine is especially constructed for farmers, a hand motion may be affixed to it if required."

THE VINE.

DIGEST OF INFORMATION GAINED REGARDING ITS CULTIVATION IN VICTORIA.

By Mr. W. E. Ivey.

INTRODUCTION.

In deciding upon the best form in which the answers already received to the annexed questions concerning the culture of the vine in this colony should be presented, it is necessary to take into consideration one or two points relating more especially to the unavoidably incomplete record any such compilation must be of so important an interest, however good the individual answers. Up to the present time, a sufficient number of replies has not been received to warrant the preparation, from them alone, of an article, or report, upon the cultivation of the vine in Victoria, which could be considered strictly authoritative. With-

out information regarding the opinions and practices of some of our largest and most successful vignerons, such a report would be open to modification, and could not be said to contain details of the practices of the most enterprising vignerons of this country.

At the same time, it may be urged that, if the information already gained be kept back until a full report could be published, it would be virtually suppressed for twelve months; and as many gentlemen have taken considerable trouble to give their experiences, and to afford useful knowledge, which probably in many cases will be of value to other vignerons, it is deemed the better plan to give this information publicity, leaving the more exhaustive treatment of the subject until the next annual report, when, it is to be hoped, reports from the whole of those interested in viticulture will have been received.

Under these circumstances has the following compilation taken its present shape, one which may be deemed the first step towards the preparation of a report upon the condition and prospects of vine-growing in Victoria.

The following are the questions referred to. These were attached to a circular forwarded, in the early part of the year, to all those known to be engaged in the cultivation of the vine throughout Victoria :—

1. By whom was the vine first introduced to your district, what is the date of its introduction, and where was it first cultivated?

2. What kinds have been principally grown, and which of them has experience proved to be best suited to the locality?

3. What system did you adopt when forming your vineyard; would you pursue the same course under present circumstances; if not, please give your reasons for any changes which you might deem necessary to make?

4. What is the acreage of your vineyard, what the character of the soil, and what the aspect thereof?

5. What system of drainage, if any, have you adopted, and does your experience teach you that a proper system of drainage is absolutely essential to the healthy growth of the vine in Victoria?

6. What distance apart, in your opinion, should the vines be placed, and do you approve of planting on the square or the triangular system?

7. What time of the year do you consider the best for planting a vineyard?

8. Give brief particulars of the system of cultivation which you adopt, making such particulars extend over the space of one year.

9. What, in your estimation, is the average cost of cultivation per acre?

10. What manures, if any, do you use; when and in what quantity do you apply the same?

11. What, in your opinion, is the average value of the various kinds of grape grown in your vineyard; (1.) As regards the quality of the wine made; (2.) As regards the yield per acre?

12. Do you experience much difficulty in obtaining labor during the vintage?

13. Do you pay your men during that season by the week, or by the piece ; what is their average rate of wage, and under what conditions is the same subject to variation ?

14. Have you noticed much disease among your vines ; if so, what is the nature thereof ? If you have suffered loss from the oïdium or the black spot, please state when these diseases first made their appearance in your vineyard, and what steps, if any, you took to get rid of them. If you have noticed any new disease among your vines, please forward specimens of the diseased plants for examination ; and if you have observed any species of insect to be particularly destructive to the crop, send specimens of them likewise.

15. Give brief particulars of the climate and temperature of your locality, detailing any peculiarities, advantageous to the vine or otherwise, which you may have observed.

16. What mode of making and maturing your wines do you adopt ? Please give a brief description of the same.

17. What is the average percentage of saccharine in your musts ?

It will be observed that the answers to Question 2 have been tabulated (*see* appendix), that the opinions of those gentlemen whose names are attached may be seen at a glance. The general concurrence of opinion as to the superiority of certain sorts over others is very noticeable. Making allowance for the differences in climate between the vineyards on the banks of the Murray to the north, and those in the valley of the Yarra to the south, how few are the sorts which experience has proved to be best suited to the climate of, at least, this part of the Australian continent.

In the forming of a vineyard, opinions concur to a great extent in the advisability of adopting all such methods as will allow of the economising of manual labor. Thus, where, in the first instance, it was almost invariably the practice to hand-trench to a great depth and at great expense, experience has warranted the substitution of horse labor. One or other of the usual methods of subsoiling is now very generally adopted ; either breaking up with a subsoil plough, or an ordinary plough minus the mould-board, both implements following the common plough in the same furrow ; or by removing the first furrow and twice subsoiling, thus attaining a still greater depth. Partial trenching of rows two feet wide is also recommended in preference to the expensive trenching of the whole ground, and land thus prepared is stated to be better for the vines in a dry season.

The question of economy of labor runs through the reasons for the alterations of opinion regarding the best distance between the rows and the system of planting. All now recommend an increase from the old 4 feet and 4 feet 6 inches to 6 feet and 8 feet in the rows, so as to admit of the passage of cultivating implements, worked by horse-power. So

also in answer to Question 8—upon the system of cultivation—the plough, the horse-hoe, the scarifier, are used wherever practicable; in only one or two instances is digging by hand continued.

In other particulars of cultivation opinions differ. Climate, soil, the sort of grape, the early training of the vigneron himself, and many minor reasons, probably cause these differences in practice. Thus, pruning is performed "as soon as possible after fruit is off," and also apparently, by one or other, during all the winter months, even as late as August. The mode of pruning and of training are also subjects about which there is difference of opinion or custom. Universal testimony is, however, borne as to the first importance of good and cleanly cultivation of the soil throughout the year, with proper attention to pruning, tying, disbudding, topping, and the removal of all superfluous vegetation. Other points are of minor consequence.

The estimates given of the cost of cultivation of an acre of vines differ widely, and are illustrative, no doubt, of the different opinions as to the amount of labor to be profitably expended. The question of manuring also is to some extent a debatable one, though it is noticeable that where manuring is advocated it is generally where *table* grapes are the chief produce.

Except of experienced hands, only few complaints of deficiency of labor have been made. The occurrence of the vintage after the demand for harvest hands has ceased fully explains this; moreover, the number required is small compared with that employed by the farmer at the period of wheat harvest.

With the exception of light spring frosts, all agree as to the suitability of the climate for the development of the vine. Some, however, think that they find a western aspect better than the almost universally adopted one, to the east.

The question of the diseases of the vine is one of great importance and interest. There is but slight difference of opinion as to the occurrence of the black spot and oïdium Tuckeri, and upon the good or non-effect of recommended remedies.

The black spot appeared first some twelve years ago, and attacks the more tender varieties of the vine. Wet seasons are usually followed by bad attacks of this disease, and there seems to be no known remedy. The general practice is to graft the attacked vines with some hardier sort in the absence of any recognized useful method of attacking the disease itself.

The oïdium Tuckeri was generally observed in 1872. Sufficient experience of its habits, and the effects of atmospheric changes upon its

spread, &c., have not yet been gained. The remedial effect of an application of flowers of sulphur has, in all cases where tried, been proved. No other disease of the vine exists, nor is there any mention of the existence of any destructive insect, except in two instances, where the locust and a caterpillar are described as having done some damage.

The last two questions, referring to the manufacture and maturing of wines, have elicited several minor points of individual practice, outside the ordinary routine of pressing, fermenting, and racking. These minutiæ would be best read in the words of the writers as given under the head of Question 16. To attempt to give any description of them would necessitate transcribing many of the answers word for word. It may be observed, however, that market demands seem to interfere greatly with the proper maturing of wines, and that to secure an uniformity of quality throughout any considerable quantity of wine, the produce even of one variety of grape, a more general system of making and maturing wine on a larger scale must be initiated. The specific gravity of musts should be also more generally ascertained, saccharometers by the same maker being used in all cases throughout the country.

The answers to the questions, which follow, are given verbatim in most cases, and the substance in others, as in those tabulated.

In answer to Question 3, as to best system for forming a vineyard—

Mr. Crippa, Hepburn, writes:—"Trenched 2 feet; vines 3 feet apart; would now recommend rows to run north and south, at a distance of 8 feet, or distance of 4 feet east to west, and 6 feet north to south."

Mr. F. Schmitt, Berwick, prefers the system he followed in Germany, at Rheingau, where the practice is to trench by hand, 3 feet wide by 2 feet in depth.

Mr. Vettler, Echuca:—6 feet by 4 feet; trained on two wires, pruned rod and spur system.

Mr. Shaw, Goornong, throws out trenches 15 inches wide and 18 deep; puts in the cutting, and loosens both sides with forked hoe before filling in.

Mr. W. Hall, Kingower:—"Originally planted angular system; rows 6 feet, and 5 feet between vines. It would be better to have the rows further apart, so as to have the earth stirred by a plough, and kept clean at less expense;" and would recommend "stout poles, 7 or 8 feet high, with horizontal plates on top, with wire stretched over them; the branches of the vines to be trained over the wire, so as to form a kind of roof, on which portion alone the grapes should grow, thus shading the ground from heat, and diminishing risk of loss from wet weather."

Mr. Strachan, Axedale, at first trenched 2 feet; last planted, double ploughed 12½ inches, which is the best.

Mr. Cameron, Timor, first planted 4 feet 6 inches both ways; trenched 2 feet. Second planting, 6 feet both ways; trenched 18 inches; but prefers, as

best and cheapest, plough-trenching, rows 8 feet apart, and vines 4 feet 6 inches apart. The trenching is performed by opening a trench 3 or 4 feet wide, by a depth of 18 inches, the whole length of the ground, then, with a common plough, plough the same width as the trench has been opened. One furrow will necessarily fall into the trench, the rest must be turned in by hand (best done with long-handled shovels). The second furrow, in depth, is broken up by a light subsoil plough, and removed in the same manner as the first. A third furrow is then broken up, but not removed, if a sufficient depth has been attained, and subsoil well broken. Cost, £15 to £20 per acre.

Dr. A. Mueller, Yackandandah:—Hand-trenched 2 feet deep.

Mr. Jean Merle, Daylesford, planted 4 feet by 4 feet; would now plant 6 feet by 4 feet, the wider distance north and south.

Mr. Jas. Webster, Beechworth, trenched 3 feet deep. Cost, £35 per acre. Planted 4 feet apart; would now plant 5 feet, and in poor ground 6 feet apart.

Mr. F. Mellon:—Rows north and south, 6 feet by 5 feet.

Cowan and Paton, Beechworth, trenched 20 inches; planted 5 feet apart.

Mr. Spink, Tarrawingee:—Plough-trench with six horses, going twice over the ground.

Mr. G. Cook, Plumstead Grange, Bet-bet:—First, trenching by spade, 3 feet deep; afterwards by subsoil-plough, specially made. The latter is the best plan, as preserving the sandy surface; breaking up the clay subsoil, but not bringing it to the top.

Mr. J. Wood, Myers' Flat, trenched 2 feet deep; afterwards ploughed 15 inches, which answered very well.

Mr. W. Botten, Eddington, trenched with plough—first, horse-team, followed by strong team of bullocks; depth, 20 inches.

Mr. A. Bruhn, Strathfieldsaye, first trenched all land 18 inches; should only trench rows 2 feet wide, 18 inches deep. Ten years' experience teaches that vines planted in trenched rows do not suffer in a dry season so much as where the ground is all trenched. Planting at first was 4 feet by 4 feet, now 7 feet by 4 feet, which distance is more economically worked.

Mr. C. Maplestone, Ivanhoe:—"When I planted my vineyard, rooted vines were not to be had. Cuttings were obtained and planted in nursery rows in 1859, having, previous to planting, placed them in bundles in water to the depth of 2 or 3 inches, till the buds began to swell, and then planted, and more than 90 per cent. struck.

"In the month of May, the following year (1860), the vineyard was trench-ploughed, with two ploughs, one following the other—the latter without a mould-board—to the depth of 16 inches. When all was finished and harrowed and regulated, a trench was formed for each row of vines to the full depth of the ploughing, with a plough having a mould-board on each side, cleaned out by men following with shovels; then broken bones, averaging about the size of one's finger, were laid in the bottom of the trench, 2 or 3 inches deep, in an unbroken line from end to end; the trenches all filled up, and the ground levelled and regulated. In July 1860, the one-year-old rooted vines, which had been planted the

year previously in the nursery, were planted in rows six feet apart, by 4 feet 6 inches from plant to plant, using about half a bucket of compost to each. Nearly all the vines succeeded. I tried a great many varieties, many of them incorrectly named, and have cut most of them down from year to year, and grafted either the Hermitage or Shepherd's Riesling upon the stocks.

"In 1865 and 1866 I planted three other smaller vineyards : one of them was hand-trenched 2 feet deep, and the whole bottom covered with bones mixed with manure ; drained with 1½-inch pipes, 4 feet deep and 15 feet apart. This perhaps would not be thought to pay on a large scale. The preparation cost me at the rate of £200 per acre, *before planting or trellising ;* but I believe it has already cleared itself, and paid well. It is planted twice as close as the first vineyard, that is, 4 feet between the rows, and the vines 3 feet 6 inches apart in the rows. It never fails to yield a heavy crop. The vines are vigorous and healthy, and the fruit matures thoroughly. About half the vines were planted in the first instance with a handful of Bird Island guano, well mixed with the soil ; the other half with the same quantity of Flemington bone dust ; the former was a complete success, and the latter almost an utter failure, and had to be almost entirely replanted the following year. Whether my inference be correct or not, I attribute the failure with the bone-dust to the nitrogen about the bones being too strong for the small tender rootlets of one-year-old plants ; perhaps two or three-year-old vines would not have suffered in the same way from the bone-dust. The guano contains very little nitrogen, but upwards of 80 per cent. phosphate of lime.

"I purpose planting 10 acres more of vineyard next season. I am thinking of trench-ploughing about 18 inches deep, and of draining with pipe-drains 4 feet deep, and perhaps a chain apart, and to plant the vines 6 feet by 4 feet 6 inches."

Upon the question of drainage opinions are almost unanimous as to its absolute necessity where the site is not naturally drained. The selection of site has, however, been paid great attention to generally, as the return to this question is usually "naturally drained," however strongly the vigneron may express his opinion upon the necessity of its being done where the subsoil is retentive and vineyard on level ground :—

Mr. Schmitt, of Berwick, uses stone drains every 15 feet—3 feet deep.

Mr. Maplestone—1½ inch pipes, 3 to 4 feet deep.

Mr. Bruhn states :—"I believe a proper system of drainage will in a great measure prevent the oïdium from making its appearance."

Mr. Shaw :—"I consider the want of drainage to be the cause of the different diseases that have attacked my vines."

Mr. Webster :—"I escaped (oïdium) with only a slight touch, and put it down to the quick growth of vines on account of the extra rain we had not lodging."

Mr. McKinley :—"It is useless on a retentive subsoil to plant a vineyard without perfect drainage."

Mr. Botten :—"On flat land I consider draining the first step towards forming a vineyard."

The system of cultivation in vogue in different districts and practised by the several vignerons differs considerably in many particulars. Thus Mr. Crippa writes, in answer to Question 8 :—

"After a vintage is over the vines are cut, the sticks or supports prepared, and vines fastened ; the ground is afterwards dug by hand and cleaned of weeds. When the vine is growing, the shoots to be used as cuttings for the following year are fastened and dressed. The shoots unnecessarily growing are cut, and the vines and ground generally again cleaned until the grapes come to maturity,"

Mr. Schmitt :—"The first work after harvest is to manure and to dig it down with two-pronged hoe or spade. Pruning follows, which is best done in July. Then stakes are placed and vines fastened, the shoots, which are left about 2 feet long, being tied in a bow to the stakes, then dig with the hoe for the first time. When the vines are grown about a foot long break out all superfluous shoots—as soon as the young shoots will bear tying this is done, the second hoeing progressing the while. When the berries begin to get transparent the tops are cut off—if this be done sooner the grapes suffer from the sun."

Mr. Young :—When vines are three years old cut back the wood to second bud of the last year's growth ; after young wood has grown about seven joints or buds take off one joint to strengthen those remaining ; about three weeks after this, take off all laterals or side shoots, leaving from four to six leading shoots, according to the strength of the vine.

Mr. Vettler, Echuca Vineyard, says :—"About the middle of May I commence pruning (rod and spur system), the bearing-rod tied to lower wire. After pruning I plough for the first time *on* to the vines, so as to form a furrow between every two rows. As soon as the buds begin to break I plough for the second time *off* the vines, so as to form a crown between every two rows. In October, disbudding and the first sulphuring are commenced as soon as the vines have grown 6 to 8 inches. All the shoots are topped three leaves above the last grape, with the exception of two long shoots from the spur to form the new bearing-rod for next year, which two shoots are tied to the top wire. Horse-hoe and hand-hoe are used in keeping down weeds, and after first sulphuring I go over with the sulphur every three weeks until about the middle of January, when all the tying up, &c., is finished."

Mr. Shaw prunes Hermitage on the long rod system, ploughs after pruning, and ploughs and scarifies after first tying, and hoes between rows.

Mr. Hall prunes July or August, gooseberry fashion.

Mr. Strachan prunes as soon as possible after the fruit is off, tie old wood, plough, plough again in spring, disbud and tie young shoots. Horse-hoe as required, and stop shoots where too strong.

Mr. Cameron ploughs twice annually and keeps clear of weeds, ties portion of vines to stakes, and portion gooseberry fashion.

Dr. A. Mueller writes:—"Pruning commenced in June, finished early in August, after that hoeing till end of October. In November and December, hand-pruning, then tying to stakes and topping, which latter operations, being carried on partly simultaneously with the hand-pruning, are generally finished early in January. Vintage in April."

Mr. Jean Merle:—"I work the ground with the hoe; then pluck all bad or useless kinds of vine after cutting; then tie to stakes or props prior to blossoming; tie a second time when the grapes are about the size of a pea; then cut off the high tops of the vines, and keep ground clear of all weeds."

Mr. Jas. Webster:—"Pruning, digging by hand, disbudding twice, tying twice, topping and taking off laterals. Some people believe in taking the tops off as soon as possible, to let the goodness go to the grape; but this causes the laterals to shoot out stronger, which takes more from the vine than the growing tops, and gives extra work."

Mr. F. Mellon ploughs end of autumn, and again in spring, not deeper than 4 inches.

Messrs. Cowan and Paton :—Dug once a year; weeds kept down.

Mr. G. Cook :—"Ploughing *out* in winter and *in* in summer, with use of horse and hand hoe to keep down weeds."

Mr. J. Wood never ploughs or digs; uses hoe.

Mr. Maplestone :—"I prune as soon as the foliage is off, and as soon as this is done give the first ploughing, if the weather will permit; but sometimes on my land, if the rain come early and heavy, I cannot put a plough in till late in the season, and then it gets only one ploughing; but if the season be suitable for early ploughing, the sod is turned towards the vines, and the furrow left in the middle between the rows, and turned back again the second ploughing, which is done in the spring, as soon as the weeds begin to show. Afterwards, when the weeds appear, the scarifier is put to work, and sometimes the harrow, and hand hoeing between the vines. In the beginning of October the disbudding requires to be done; and before the end of that month the fruit-bearing shoots which are allowed to remain are tied to the second wire (the leader left from last year's wood having been already tied to the bottom wire). There is then almost constant work in tying the fruit-bearing shoots and new leaders to the upper wires till the end of December or beginning of January. I keep the hoe constantly going through the summer, and keep down all superfluous shoots on the vines, always bearing this in mind, *not to allow any foreign vegetation around the vine, nor any useless vegetation upon it.*"

Mr. McKinley :—Plough in spring and hoe between plants; harrow from time to time as long as can go between the rows, and use hoe the rest of the season.

Mr. W. Botten writes:—"I begin to prune the first week in June. When finished, and the prunings carried off, I plough between the rows. As soon as the vines begin to shoot in the spring I disbud them, and plough again. As the vines grow I give them a preliminary tying—with rice bags unravelled—and when they have reached the top of the stakes I tie with

strands of Manilla rope; then run the horse-hoe through and across, and hand-hoe round the vines. In December I top the vines and break out the laterals. Very little more work is required until the vintage. When the vintage is over, I choose a few fine days to run the horse-hoe through, which keeps the ground clear from weeds until pruning and ploughing."

Messrs. Bruhn:—"Pruning takes place in June and July, and should be done early; soil is then broken up by horse or manual labor, which should be finished by the middle of September. As soon as the vines have grown about 12 inches, disbudding and tying may commence, which should be completed before the vines bloom. As soon as the berries have properly set, the second tying should be done and the tops cut off. All weeds should be kept down. The vines, till the vintage, will require to be trimmed, and the tops cut off where the growth is strong. The vintage commences about the beginning of April."

Upon the question of diseases amongst vines, Mr. Vettler says:—

"The oïdium Tuckeri made its first appearance in this vineyard on the 2nd January 1872. I always got rid of it by using flowers of sulphur, and have suffered no loss whatever through it. The black spot made its first appearance here last year, and destroyed tons of grapes. This year there is none to be seen. I attribute the existence of black spot to cold wet nights. There is no remedy for it."

Mr. Deason:—Black spot appeared in 1871; oïdium this year.

Mr. Crippa has no disease amongst his vines.

Mr. Schmitt:—None till last year, when black spot appeared, which he thinks due to wet weather.

Mr. Young has suffered much from oïdium. Black spot appeared in 1871.

Mr. Shaw writes:—"For the last 12 years, whenever there has been a wet winter and spring, we have had the black spot on some kinds, the Hermitage excepted, which seems to grow more wood. I noticed oïdium for the first time last year. I visited several gardens and vineyards to ascertain the cause of disease. I found trenched ground, not drained, the worst. Upon untrenched but drained ground the most delicate sorts of vines bore a very fair crop."

Mr. W. Hall had black spot upon the Sweetwater one or two wet seasons.

Mr. Strachan:—Has had "black spot upon Sweetwater and Muscatel for a number of years. The cure is to cut them down and graft with a hardier sort. The oïdium first appeared in 1872 on a few Verdeilho, which I rooted up. In 1872–'73 some Chasselas in a low-lying corner were rather bad; I sulphured them, and the disease did not spread until the end of the season, when it became very general on the autumn grown unripe shoots and second-growth bunches of fruit. I pruned as soon as the fruit was off, and carried the cuttings off the ground. It appeared in the same spot this season, but, instead of sulphuring, I trimmed the vines well, taking off all surplus wood and leaves, and also second crop bunches, thereby letting the sunshine and air well in. This treatment, in my opinion, was as effective as the sulphur last year. It is, however, now showing in a similar manner to what it did last autumn. My own opinion is that a vineyard, for which a proper site has been chosen, and

planted so that air and sunshine can penetrate thoroughly, the vines being trained to a wire trellis in preference to being tied to stakes, will suffer to a comparatively slight extent from either black spot or oïdium. I would not manure, or but very slightly, neither would I close fence nor plant trees for shelter. In making these remarks, I by no means wish to decry the value of sulphur as a cure, but would draw attention to what I believe to be to a great extent a preventive."

Mr. Cameron says :—"I have had black spot for the last three years on the Sweetwater variety, but have grafted Burgundy on to them this season. About 75 per cent. have struck and made immense wood, with fine bunches of fruit. Last year I had what I thought to be oïdium ; I used sulphur after the fruit had set this season, and do not see any sign of it as yet."

Dr. A. Mueller :—"Black spot only troubles me in wet seasons. Oïdium has been in my vineyard for three years, but is kept down by sulphuring with bellows. Against the black spot I know no remedy."

Mr. Jean Merle :—"I have noticed the oïdium and black spot, the latter has been very light, and appeared in December for two years and disappeared. The oïdium appeared in January 1872 in one spot, and then spread in February and March. The damage done was considerable. In 1873, before it made its appearance, I applied sulphur three times, and it stopped the disease. I sulphured to the height of the grapes, and the oïdium did not show itself so far, but the tops where I did not apply sulphur were full, though without causing any loss. I have this year so far applied sulphur twice, but have not observed any sign of disease."

Mr. Spink :—Oïdium appeared first last year. Black spot six years ago.

Messrs. Cowan and Paton :—Oïdium in 1873. Very bad on Riesling and Burgundy this year.

Mr. Webster :—"Last year some of the Verdeilho grapes were attacked by oïdium, to which sort it has since confined itself, getting gradually worse. I have this season treated them as follows :—One half the affected vines I painted (just when the sap was rising, and after taking all the bark clean off) the stems and all the old wood, allowing a good deal to run down the stem into the ground, with the following mixture :—3 ozs. sulphur, 2 ozs. lime, 1 gallon water, boil for half an hour ; the other half was tried with dry sulphur, after the young shoots were well out. A few rows, where the disease was worst, were both painted and sulphured."

Mr. Mellon states :—"I had, for the first time, last season black spots on the table vines. At the pruning time I cleaned the stems well of all the old bark adhering to them, and, by so doing, destroyed the nests or receptacles of the insects, and this year I perceive no signs of any disease."

Mr. G. Cook :—Black spot only ; always after wet spring for 12 or 14 years.

Mr. J. Wood :—A little oïdium ; the last two seasons early in summer ; this season beginning of February ; has not done much harm. Sulphur is a remedy. Black spot has not done much harm as soil is porous, and the disease undoubtedly arises from the soil being overcharged with moisture, the temperature being therefore low.

Mr. Maplestone replies :—"I have noticed the black spot for several years, notably upon the Sweetwater and all the Muscats. For this disease I know

of no remedy, except cutting down below the ground and getting an entirely new growth. By adopting this plan, the disease may not appear for two or three years. A good teaspoonful of sulphur is deposited at the stem of every vine soon after the ground is ploughed in spring, to keep off the oïdium, or at least to moderate its attack, should the vineyard be visited by the disease. For the last year or two a continual watch has been kept for its appearance, and the prompt application of sulphur with the bellows generally keeps it in check, and prevents any injury to the vine or fruit. I have tried fumigation by setting fire to sulphur in an earthen vessel and drawing it along upon a small hand-truck between the vines, but the fumes are uncontrollable, and a little motion in the air will send them where they are not wanted."

Mr. McKinley has no disease in his vineyard.

Mr. Fletcher has rust, oïdium, and black spot; thinks his vineyard too near the water.

Mr. W. Botten:—"In wet years a little black spot on the white grapes, but nothing to speak of. The oïdium made its first appearance here in 1872, in December, and soon spread. This year it came about the same time, and in adjoining vineyards that were comparatively free from it last year. I did nothing last year, and suffered severely at vintage time. This year I have sulphured all my vines, and think it has decidedly checked the oïdium, but in future will pursue the plan we followed at home—sulphur before flowering, again after the setting of the fruit, and a third time before the fruit begins to color."

Messrs. Bruhn:—"We have had a little oïdium, principally in the Verdeilho. One dressing of sulphur fully succeeded in checking the spread of the pest. The disease made its first appearance with us in 1872. The black spot we noticed first in 1862, after which it did not again appear until 1871, '72, and '73. We have seen no black spot this year, and believe it comes mostly in wet seasons."

In answer to Question 16, as to the making and maturing of wine—

Mr. F. Crippa writes:—"The grapes, when fully ripe, are slightly pressed in the vats, and left there to ferment six or seven days. Then the wine is drawn and placed in casks kept open for eight days, during which they are kept filled, then properly closed. In three or four months they are re-opened, re-filled, and re-closed until required for use."

Mr. Schmitt:—"As soon as the grapes are gathered they are put in the press. The must is filled into casks of different sizes. After fermentation—say three months—the wine is racked the first time; a second time in three months from first racking; and a third time six months after the second."

Mr. Young follows the old system of treading out the grapes, "as mills sometimes break the stones and bruise the stems, causing the wine to become acid."

Mr. Vettler states:—"All the grapes are crushed by the grape-mill, and fermented in vats until a head rises; then the liquor is run off into casks, and the remainder pressed thoroughly dry. Red and white grapes are treated alike. For maturing the wine I use an overground cellar. New

wine I rack off every two months, older wines every six months ; always keeping the casks quite full."

Mr. Shaw follows Guzot on wine making, as far as practicable.

Mr. Strachan :—"Crushing in the grape-mill is followed in the case of white grapes by immediate pressing, whereas the black grapes are fermented in the skins before pressing. The must is then placed in casks to finish fermenting, and after some weeks is racked off ; and, with the exception of filling up, is untouched until spring, when it is again racked and placed in the market."

Dr. A. Mueller :—"The grapes are crushed in tubs by treading, and the white ones at once transferred into the press, the red ones being left unpressed until sufficient coloring matter is extracted. The juice is fermented in large casks of 350 to 500 gallons capacity, open only at the bung-hole, which is left uncovered during the first violent fermentation. As soon as this is over the wine is racked off the lees, and remains above ground for the first twelve months, being racked four times during that period. Just before the vintage of the following year it is removed into the cellar, racked three times during the first, and twice during each subsequent year. When it is three years old it receives what finings may be required, and is then brought into the market."

Mr. Jas. Webster uses "a large sieve made of wire with wooden frame, which fits on top of the fermenting tubs. On this the grapes are put when brought in, and squashed with the hand, the juice running through into the tub. When full it is allowed to ferment until the temperature is about 60°, or a little over, and then taken off and put through the press, and from that into casks in a cellar, and allowed to ferment as long as it will, first with the bungs slightly loose, but nothing done to check fermentation. I rack off twice in twelve months, but the oftener it is done the better."

Mr. F. Mellon says :—"For red wine I ferment the stems with the grapes, as I consider the tannin indispensable to the keeping of our alcoholic wines. I allow the must to ferment for three days. I never mix the wine coming freely from the vat with the wine coming from the press. For the white wine, or liqueur, I crush, press, and put the juice in a vat to ferment. As soon as the wine begins to ferment I skim it well. After the heavy lees are deposited I decant it into a cask."

Mr. George Cook :—"White wines.—Crushed in a vat, juice run into casks filling to two-thirds ; then contents of vats, skins and frames, put into press, and the juice therefrom distributed amongst the partly filled casks, the contents of which are then allowed to ferment as ordinarily. Red wines.—Crushed, and entire results carried into 200 and 300 gallon vats, fermented and drawn off, murk pressed, and result of pressing distributed—for tannin—amongst the various casks. Both white and red, after fermentation, are kept in an overground storehouse till the following October, receiving during the interval the necessary racking. In October they are placed in underground cellar, left in wood for two years, and, where possible, seven years in bottle ; but trade demand often renders the latter impossible."

Mr. Maplestone:—"For white wine, the berries are stripped from the stalks, the stalks all removed, the berries gently crushed, and the pulp and juice conveyed into the vat. This is all done at one operation, with perfect cleanliness, by a machine made under my own directions. The whole is left from 12 to 24 hours, until fermentation just commences. The must is then drawn off into another vat, the murk pressed and the juice (or must) added to the other must, and left covered over, but not air-tight, till the fermentation is quite completed, when it is wine, and is drawn off into the casks in the cellar, and bunged down tight, the sp. gr. being generally about 995°.

"For red wine the same process is adopted, except that the must is not drawn off from the skins till the fermentation is completed, when the murk is pressed, and the must added as before described. The wines are all racked from the lees about four months after the vintage, and subsequently racked twice in each year till sufficiently mature for bottling."

Mr. W. Botten:—"For red wines, when the grapes are thoroughly ripe, I crush and ferment them on their skins in vats for about 48 hours, or, if the weather is cold, until they begin to get quiet, then draw off the juice into casks, and press the murk. For white wines, I crush and press at once, and place the juice in casks with their bungs out, and let it ferment until quiet, then rack all the wines off the yeast. In about six weeks after wine-making I rack them all off into fresh casks, and again in August, and before the next wine-making, always keeping the casks filled up. Age and frequent racking are all I depend upon to mature my wines."

Messrs. Bruhn:—"In gathering the grapes great care is taken that all the unripe berries are removed; they should be gathered in wooden buckets or pails made for that purpose. The white grapes are first crushed by means of a grape-mill, then put in the press and pressed, and the must filled in casks in the cellar, or a fermenting-house, a small sand bag being put on the bung-hole when the rapid fermentation is over, which is generally the case in six or seven days. The cask is filled full to the bung, and should always be kept full by filling up once a week at least. When the wine is about five or six weeks old it should be racked (first sulphuring the cask which is to receive the wine), and racked again in September, and the third time in December. If the wine is bright, it will not require racking again for about four or five months.

"After the red—or black—grapes are gathered the berries are taken from the stalks, by means of a machine we have for that purpose, which works well. The berries are then crushed in the grape-mill, and put into a fermenting vat, filling about three parts full. A false bottom is now put in about two or three inches below the surface of the wine. This arrangement is made of battens, and in two halves, forming, when put together in the cask, a network, and is so fixed that it cannot rise above the wine. Its purpose is the keeping of the husks below the wine. The vat is then covered up, and remains so for about four or five days, according to the temperature of the weather. The wine is then drawn off into casks, and treated the same as the white wine."

In answer to Question 17, inquiring the percentage of saccharine in the musts, Mr. John Vettler sends the following:—

GRIMOLDI'S WINE SACCHAROMETER.

Verdeilho	... ...	1120 sp. gr.
Riesling	... ...	1104 „
Pedro Ximenes	... ...	1113 „
Hermitage	... ...	1117 „
Leverdun	... ...	1120 „
Carbinet Sauvignon	... ...	1113 „
Grenoche	... ...	1111 „
Mataro	... ...	1102 „
Sherry	... ...	1110 „

Mr. Spink has obtained the following results with the same saccharometer:—

In 1870	... ...	1105 sp. gr.
1871	... ...	1108 „
1872	... ...	1118 „
1873	... ...	1110 „

Mr. Maplestone:—About 1100; a little above in 1869, 1870, 1871, and 1873, and a little below in 1872.

Dr. A. Mueller gives the sp. gr. of his musts at 1112 to 1150, and even 1160, Port Phillip Saccharometer.

APPENDIX.

TABULATED STATEMENT OF REPLIES TO QUESTION 2.

Name.	Locality.	Sorts grown.		Sorts best suited.	
		Red.	White.	Red.	White.
Cowan & Paton	Three-mile Creek	All sorts		Malbec .. Shiraz	Tokay Riesling
Geo. Spink ..	Tarrawingee	.. .. ..	.. .. ..	Shiraz ..	Riesling
Jas. Webster	Sydenham Vineyard	All sorts		Shiraz .. Malbec	Riesling Verdeilho
W. Botten ..	Eddington ..	Many varieties		Hermitage .. Burgundy Mataro	White Hermitage or Roussane Shepherd's Riesling Gouais
F. Crippa ..	Hepburn ..	Black Hamburg Esparto Burgundy Hermitage Gamais Black Cluster Pineau	Chasselas ..	Black Cluster Gamais then Hermitage Burgundy Pineau	
F. Mellon ..	Dunolly ..	.. .. ..	.. .. ..	Pineau .. .. Hermitage Mataro	Riesling

Tabulated Statement of Replies to Question 2—*continued.*

Name.	Locality,	Sorts grown.		Sorts best suited.	
		Red.	White.	Red.	White.
John Vettier..	Echuca ..	Doncelino .. Hermitage Burgundy Leverdun Grenache Mataro Carbinet Sauvignon	Riesling .. Verdelho Sherry Pedro Ximenes	Doncelino .. (Oporto vine) Hermitage Burgundy Leverdun (Gloria Australiæ) Grenache Mataro Carbinet Sauvignon	Pedro Ximenes Sherry
C. Maplestone	Ivanhoe ..	.. .. ..	.. .. ..	Hermitage .. Mataro	Shepherd's Riesling
F. Schmitt ..	Berwick ..	.. .. ..	.. .. ..	.. .. ..	Riesling
A. Mueller ..	Yackandandah	.. .. ..	.. .. ..	Shiraz	Verdelho Riesling
Messrs. Bruhn	Strathfieldsaye	.. .. ..	.. .. ..	Hermitage .. Carbinet Sauvignon Mataro Black Cluster (Miller's Burgundy)	Verdelho Riesling Chasselas Pineau Blanc
Geo. Cook ..	Plumstead Grange, Bet-bet	.. .. ..	.. .. ..	Cluster .. Miller's Burgundy Poulson Hermitage	Chasselas Riesling
P. Fletcher ..	Carisbrook ..	.. .. ..	.. .. ..	Hermitage .. Burgundy Frontignac	Chasselas (Parsley leaf)
C. McKinley	Bet-bet ..	.. .. ..	.. .. ..	Hermitage .. Mataro Frontignac	Verdelho GoldenChasselas
Jean Merle ..	Daylesford ..	Burgundy .. Pineau Gamais	.. .. ..	Gamais	
C. Cameron ..	Timor ..	.. .. ..	.. .. ..	Hermitage .. Mataro Burgundy Terret	Riesling Verdelho GoldenChasselas
J. Strachan ..	Axedale ..	Hermitage .. Burgundy	Chasselas .. Riesling Verdelho Dolcetto	Hermitage ..	Dolcetto
W. Hall ..	Kingower ..	Over twenty-five sorts tried ..		Frontignac .. Muscatel (yellow and brown)	Chasselas
F. K. Shaw ..	Goornong ..	.. .. ..	.. .. ..	Hermitage ..	Chasselas
C. Young ..	Newbridge ..	Tried seventy varieties ..		Hermitage Esparte Black Hamburg	
W. Alford ..	Laanecoorie .	.. .. ..	.. .. ..	Burgundy ..	Riesling
J. Deason ..	.. ..	.. .. ..	.. .. ..	Hermitage Burgundy	

Tabulated Answers to—

—		Question 4.			Question 6.		Question 7.
Name.	Locality.	Acreage.	Character of Soil.	Aspect.	Distance apart recommended.	Square or Triangular.	Best Time for Planting.
F. Crippa ..	Hepburn ..	acres. 9	Chocolate ..	..	N. and S. 6 ft., E. & W. 4 ft.	Square ..	August ..
J. Deason ..	..	3	Granite ..	N.E.	6 feet ..	Triangular	..
F. Schmitt ..	Berwick ..	2	Black loam 1 foot; stiff black clay subsoil	N.W.	3 ft. by 4 ft.	..	Latter end of August and September
C. Young ..	Newbridge	6	Light loam ..	E.	5 feet ..	Square ..	June ..
John Vettler	Echuca ..	36	Red sand and loam	E. and N.	6 ft. by 4 ft.	..	June and July
F. K. Shaw ..	Goornong	3 to 4	Red loam ..	N.W.	7 ft. by 6 ft.	Wire trellis	Late in July or early in August
W. Hall ..	Kingower	2	Red sandy clay	Flat	6 feet ..	..	July or early in August for rooted vines
T. Strachan ..	Axedale ..	4	Sand, clay, and rock	N.W.	7 ft. by 5 ft.	..	Rooted vines June & July; cuttings August
C. Cameron ..	Timor ..	5	Red clay mixed with lime	N.W.	8 ft. by 4 ft. 6 in.	..	Early part of August
Dr. A. Mueller	Yackandandah	8½	Chocolate soil on slate rock	E. and N.E.	4½ ft., on richer soil 3½ ft. to 4 ft., and on poorer 5 ft.	Square ..	July ..

Tabulated Answers to—

Question 9.	*Question* 10.	*Question* 11.		*Question* 12	*Question* 13.	*Question* 15.
Cost of Cultivation per Acre.	Manures.	Value of kinds of Grape. (1.) Quality of Wine.	(2.) Yield per Acre.	Difficulty of obtaining Labor.	Rate of Wages, &c.	Climate.
£25 per acre	Horse manure and wood refuse; 1 barrowful to six square feet	For quality, Burgundy and Hermitage; for quantity, Black Cluster and Gamais		None	17s. 6d. per week, with rations, throughout the year	Favorable; slightly cold
£3 per acre	Sheep manure	..	..	Very much	20s. and board	
..	Stable manure, 40 to 50 loads per acre	..	3½ tons (table)	..	..	Favorable
Trenching and planting, £50 per acre.	None; the poorer grown the better the wine	Hermitage and Esparte, £10 per ton; others, £6 to £8; yield, 3 tons per acre		None	15s. to 20s.	Mild and suitable
£4 10s. per acre without labor in the vintage	None ..	Average yields per acre (last 3 years):—		Plentiful	..	Very dry and mild; slight frost in winter; in summer thermometer 110° to 120° in shade sometimes. Except Riesling, a better wine is made in hot seasons, but quantity is less
		Burgundy ..	600 gallons			
		Verdeilho ..	300 „			
		Riesling ..	600 „			
		PedroXimenes	1,000 „			
		Hermitage ..	500 „			
		Leverdun ..	750 „			
		Carbinet Sauvignon	250 „			
		Grenache ..	1,200 „			
		Mataro ..	1,500 „			
		Sherry ..	1,000 „			
£4 to £5, including gathering	None ..	600 gallons per acre at 3s.; Hermitage, 300 gallons at 7s. when three years old		None	20s. ..	Suffers from spring frosts sometimes
..	None ..	Yellow and brown Muscatel and Ulliade worth twice as much as any other sort. Yield in 1872 (2 acres), 1,000 gallons; in 1873, 600 gallons; besides 2 tons of grapes each year		Chinamen the best	15s.	
£6 to £8 ..	In spots, bone-dust and stable manure	Hermitage is the hardier, and makes the stronger wine; Dolcetto the better cropper, and soonest fit for use.		None	..	At times, late frosts and sustained droughts; also heavy rains at vintage time
£15 to £20 ..	Any kind of farm-yard manure, 15 to 20 tons per acre	..	400 gallons ..	Scarcity of good men	..	Dry
£12 ..	None ..	300 gallons per acre. Net profit of vineyard £200 to £300 per annum, after deducting interest on capital invested and cost of cultivation.		Only employs two men, one at £3 and one at £2 per week. Boys gathering 1s. and 2s. per day		Being well sheltered, does not suffer from cold winds in spring nor hot winds in summer

Tabulated Answers to—

—		Question 4.			Question 6.		Question 7.
Name.	Locality.	Acreage.	Character of Soil.	Aspect.	Distance apart recommended.	Square or Triangular.	Best Time for Planting.
Jean Merle ..	Daylesford	acres 6	Chocolate soil	N.	N. & S. 6 ft., E. & W. 4 ft.	..	August ..
Jas. Webster	Beechworth	2	Rich red soil, similar to that at Albury	On top of hill facing W.	5 ft. or 6 ft...	Square ..	End of July
F. Mellon ..	Dunolly ..	12	Red clay with calcareous stone; surface bi-quartz gravel	E.	Rows N. & S., rest fancy	..	Autumn ..
G. Spink ..	Tarrawingee	12	..	Level	6 feet ..	Square ..	June, as early in season as possible
Cowan and Paton	Beechworth	5	Chocolate ..	N.E.	5 feet ..	Square ..	July ..
G. Cook ..	Bet-bet ..	8	Sandy surface	N.	10 ft. by 4 ft.	..	June and July
J. Wood ..	Myers' Flat	2	Strong red clay	N.	For table grapes 9 ft. by 9 ft. trellised	..	As early after May as possible
C. Maplestone	Ivanhoe ..	3	Sandy loam, yellow clay subsoil	W.	6 ft. by 4 ft. 6 in.	Square, if staked	Rooted vines June or July, cuttings Sept. or even Oct.
C. McKinley	Bet-bet ..	5	Clayey loam, and loose limestone subsoil	Sloping slightly to N.E.	8 ft. by 4 ft. for staked vines	..	Early in August
P. Fletcher ..	Carisbrook	2	Stiff red clay	E.	5 ft. by 6 ft...	Trellis, two rails, 4 ft. 6 in. above surface	July ..
W. Botten ..	Eddington	6	Sandy loam..	N. and E.	8 ft. by 6 ft...	..	Rooted vines early in June, cuttings June to Sept.
Messrs. Bruhn	Strathfield-saye	26	Sandy soil, heavy red clay subsoil	N.W.	6 ft. by 6 ft...	..	August ..

Tabulated Answers to—

Question 9.	*Question* 10.	*Question* 11.		*Question* 12.	*Question* 13.	*Question* 15.
Cost of Cultivation per acre.	Manures.	Value of kinds of Grape. (1.) Quality of Wine.	(2.) Yield per Acre.	Difficulty of obtaining Labor.	Rate of Wages, &c.	Climate.
£20 ..	None ..	Gamais, as best	600 gallons ..	Not particularly	15s. to 20s.	Rather cold; subject to sudden frosts in Oct. and Nov.
£5 to £10 ..	None ..	Verdeilho, Shiraz, and Malbec	Seventh year, average 350 gallons per acre	None	Boys, at 1s. per day	2000 feet above sea - level. Late, but no frosts, due to W. aspect
£10 to £12 ..	Where manured wine inferior	Red: 1. Pineau, 2. Hermitage, 3. Mataro.—White: Riesling.—Sweet Wines: Muscat and Frontignac	1. Mataro, 2. Hermitage, 3. Riesling, 4. Pineau	Very great difficulty	..	Rather dry, quality of wine good
£5 ..	None ..	..	Red, 300 gallons; white, 250 gallons per acre	None ..	17s. 6d. per week	Temperature 90° to 100° in hot weather
£9, including picking and pressing ..	None ..	..	250 gallons per acre	None	£2, without rations	Frosts Sept. to Nov.
£3 to £4 for cultivation	None, do not like them	Red: 1. Poulson, 2. Cluster, 3. Hermitage.—White: 1. Riesling, 2. Chasselas	About the same for yield	None	30s., with rations	Dry and hot. Good for high class wines, but not for large yields
Trifling ..	Barn - yard, without stint	..	..	..	..	Warm and dry
£6 for labor, in some cases £10	Bone - dust and Malden Island guano	..	450 gallons per acre	None	5s. per day; vigneron, 5s. 8d. per day	Well sheltered western aspect much better than eastern
£5, without stakes	None ..	Hermitage, Verdeilho, Mataro, Chasselas	..	..	..	Late spring frosts only objection
£7 per acre ..	Very little ..	..	Bad crop, 200 gallons; good, 700 gallons	None	Dig per rod at 4d. and dinner	Situated too near water
£6 to £7, exclusive of gathering and wine-making	Heavy dressing of well-rotted farm-yard manure after ploughing in July, ploughed down in spring	Black and white Hermitage makes a wine worth 25 to 50 per cent. more than any other grape, and yield as good a crop		None	20s. and board	Hot and dry autumn favorable to wine making
£5 10s. ..	None ..	About £31 per acre, at an average yield of 250 gallons. This is only an average, as the finer wines would bring more than three times that amount		None, except scarcity of experienced men	15s. for ordinary men; 20s. for experienced; boys, 5s. to 7s.	Particularly advantageous for wine growing

DIGEST OF THE FENCING AND IMPOUNDING ACTS.

Fencing Act.

The Act to amend the law relating to dividing fences, which passed both Houses in the last Session of Parliament, is divided into parts as follows:—

Part I.—Introduction.
II.—Construction of Dividing Fences.
III.—Maintenance and Repairs of Fences.
IV.—Proceedings for the Recovery of Contributions.
V.—General Provisions.

Part I. provides for the repeal of the Fences Statute 1865, the interpretation of terms, and the definition of a sufficient fence within the meaning of the Act. No fewer than eleven kinds of fence are described, either of which, or a combination of the seven first of which, is deemed sufficient. In the case of a post and rail or wire fence, the requisite height is fixed at not less than three feet six inches, and the distance between the rails or the bottom rail and the ground, and the three bottom wires or the bottom wire and the ground, at not more than twelve and seven inches respectively. A paling fence must be at least three feet six inches in height, with no greater distance between the palings than four inches; a bank or wall, a log, or a chock and log fence, at least four feet in height, and substantially built; a hedge and ditch, or any other fence and ditch, at least five feet six inches from the bottom of the ditch; and a natural stream, ditch, or watercourse, not less than seven feet broad at the top, four feet broad at the bottom, and three feet six inches deep.

Part II. deals with the construction of dividing fences. Occupants of adjoining lands are liable to contribute equally towards the construction of a dividing fence. When a river or other natural watercourse forms the boundary between contiguous lands, but is not sufficient to resist the trespass of cattle, the adjoining occupants may agree upon a line of fence on either side of such river or natural watercourse; and in the event of their not agreeing, either party may call in the nearest police magistrate, or any other magistrate they may agree to select, who shall fix the line of fence. Any occupant may serve his neighbor with notice to fence, which notice must specify the boundary to be

fenced, and the kind of fence proposed to be constructed; and if within one month after the service of notice no agreement be come to as to the construction and kind of such fence, two or more justices, on the complaint of either party, may make an order prescribing the kind of fence to be constructed, and what portion thereof shall be erected by each party, or may refer the determination of the matter to arbitration. If, after an agreement has been come to, or an order of justices made, either party neglect to construct his portion of the fence within the time named, or, if no time be named, within three months after the date of such agreement, the other may construct the whole fence, and recover half the cost of construction in any court of competent jurisdiction. When an occupier is absent from the colony, or cannot be found, or when land is unoccupied, the occupant of the adjoining land may insert in a newspaper circulating in the district a notice, addressed to the occupier of such land, requiring him to contribute to the construction of a fence, and may then proceed *ex parte* to obtain from two justices, or an arbitrator appointed by them, an order or award authorizing the construction of the fence, and may serve notice upon any person, within one month of their going into occupation of the adjoining land, and recover one-half the then value of the fence; but if the order made *ex parte* be inequitable, any two justices, on the complaint of any person interested, made within one month after service of the order, may relieve the complainant from the whole or any portion of the sum claimed as the value of the fence. When a fence is constructed on lands held by a tenant, and the interest of the tenant at the time is less than for a term of three years, the whole; when for a term of three, and less than six years, three-fourths; and when for a term of six, and less than twelve years, one-half the cost of the fence, shall be borne by the landlord, and the tenant may set off any sum recoverable by him against the rent. But when the interest of the tenant is for a term of twelve years and upwards, the whole cost shall be payable by the tenant. The foregoing provisions do not affect any agreement made or to be made relative to the erection of a fence between landlord and tenant. The occupant of land bounded by a road, if he desire to plant a live fence on the common boundary between his land and such road, on giving one month's notice of his intention to the council of the municipality within which the road is situated, may proceed to construct a fence on the road; but no part of the fence shall be more than six feet distant from the nearest point on the boundary of his land, nor the width of the road for traffic in no place reduced less than thirty feet; any two or more justices, however, within one month after the service

of notice on the council, and good and sufficient cause shown, may order the occupant of the land not to proceed with the construction of the fence.

Part III. provides for the maintenance and repairs of fences. Adjoining occupants are liable to contribute to the cost of repairing a dividing fence in equal proportions. Any occupier may serve his neighbor with notice to assist in repairing the fence dividing their lands, and if his neighbor refuse or neglect for the space of one week to comply with such notice, may repair the whole fence, and recover one-half the cost of repairing the same. When a dividing fence is destroyed by accident, either occupant may immediately repair the same without notice, and recover one-half the cost from the occupier of the adjoining land ; but when a fence is destroyed by fire, or the falling of any tree, the occupier through whose neglect the same was caused is liable for the repair of the entire fence.

Part IV. sets forth how contributions may be recovered. All proceedings for orders, and for the recovery of sums of money, must be made in a summary way before any two justices, and every complaint heard at some Court of Petty Sessions sitting near to the locality.

Part V. embraces general conditions. Nothing in the Act affects any agreement made or to be made between landlord and tenant, or between occupiers of adjoining lands. The Act does not apply to unalienated Crown lands, nor to any public officer appointed for the administration, management, or control of Crown lands or public works. Persons engaged in constructing or repairing a fence, their agents or servants, may enter at all reasonable times upon the contiguous lands to effect the construction and repair of such fence. Nothing contained in the Act affects a substantial fence already erected. The duration of the Act is three years from its commencement, viz., from the 1st January 1874.

Impounding Act.

The first five sections of the Pounds Act are taken up with the title and commencement of the Act, the repeal of the Pounds Statute 1865, the interpretation of terms, and the establishment and abolition of pounds. Power is given under the Act to the Governor in Council and local bodies, as the case may be, to appoint, suspend, or remove a poundkeeper, and for the payment of such officer by a fixed salary, and not by fees. All rates and fees payable at the commencement of the Act remain good until new ones are fixed under its provisions. The salary of the poundkeeper, and the expenses connected with any

pound, are to be defrayed, as the case may be, out of any Parliamentary grant for that purpose, or out of the fund of the local body; and all fees set forth in the First Schedule of the Act are to be collected by the poundkeeper, and form part of the consolidated revenue or part of the municipal fund. Local bodies have power, from time to time, to fix sustenance fees and trespass rates, subject to the approval of the Governor in Council. The owner of any stallion, bull, or ram found trespassing is liable to a fine of £5, in addition to trespass rates. Trespass rates are payable in the first instance to the poundkeeper, who holds the same for the person entitled thereto.

No cattle may be impounded for trespass—goats, pigs, entire horses, bulls, and rams, excepted—if the owner, his agent, or overseer, be resident within five miles, and his address be known to the person on whose land the trespass is effected, or some person acting on his behalf, until forty-eight hours' notice to remove the cattle shall have been given; but if the land trespassed upon be under tillage, and substantially enclosed, or the cattle have been found trespassing a second time within twelve months, they may be driven to pound forthwith. The occupier of any land may restore trespassing cattle to the owner, and demand the trespass rates, and in the case of non-payment recover the same before any two justices. Persons detaining cattle more than three days without impounding them are not entitled to recover any trespass rates or other fees. When cattle have been seized for trespass, the owner, or some other person on his behalf, may tender the trespass rate to the person having charge of the cattle, who shall forthwith deliver up the same. Occupiers of land, and Crown lands bailiffs upon Crown lands, may destroy, or cause to be destroyed, goats, pigs, and geese found trespassing; and if the owner fail to remove their carcasses within twelve hours may bury the same. Cattle must be impounded in the nearest accessible pound to the place where the same were found trespassing. Occupiers of land adjoining a public road, if the road be substantially fenced on both sides, may impound cattle wandering without control upon the same. Every poundkeeper is required to keep a pound-book in the form of the Third Schedule of the Act, and to make all entries therein with the utmost expedition. All fees, charges, and rates authorized by the Act must be painted in white letters on a black ground, and erected on some conspicuous part of every pound; and when cattle are impounded, a notice posted by the poundkeeper, giving particulars of such cattle. The poundkeeper is to detain in his custody all cattle lodged in the pound until the trespass rates and other lawful charges shall be paid, or until he shall receive an order authorizing

their release without payment of the trespass rates. Owners of cattle may register their brands upon payment of a fee of Five shillings ; and every poundkeeper is to give notice forthwith to persons so registering ; and in cases where brands are not registered, insert in the *Government Gazette*, and a newspaper published in the district, a notice in the form of the Fourth Schedule of the Act. Cattle not released from pound within twenty-one days are to be put up to public auction, and if no purchaser be found, or the cattle be not worth the sustenance fees that would be payable during the interval between that and the next day of sale, the poundkeeper may cause the cattle to be destroyed, and dispose of the carcasses as he may think best. The proceeds of all sales of impounded cattle are applicable in payment—firstly, of any expenses attending the sale ; secondly, of sustenance fees ; thirdly, of fees and charges payable, as the case may be, into the consolidated revenue or any municipal fund ; and, fourthly, of trespass due to the impounder, and the residue, if any, to the owner. The owner of impounded cattle may give notice in writing to the poundkeeper of his intention to complain to a justice against the person impounding, or that the rates demanded are excessive ; and every such complaint must be made within ten days after the giving of the notice, and shall be heard in a summary way before two justices. A notification in the *Government Gazette* is deemed *primâ facie* evidence of the establishment or abolition of a pound, or of the appointment, suspension, or removal of a poundkeeper, or of the fixing of any rates, fees, and charges under the Act. If a poundkeeper commit any of the offences enumerated under section 31 of the Act, he shall, on conviction, pay a penalty not exceeding Fifty pounds, or be imprisoned for a period not exceeding six months ; and when charged with neglecting to provide sustenance for cattle impounded, or losing any impounded cattle through neglect, the burden of proof shall be on him. If any other person commit any of the offences enumerated under section 33, he shall, on conviction, be subject to a similar fine, or term of imprisonment. Nothing in the Act affects the Land Act 1869.

REGULATIONS ISSUED BY THE DEPARTMENT OF AGRICULTURE.

Encouragement of the Growth of Flax.

Regulations in connexion with the sum granted by Parliament for the encouragement of the growth and production of Flax.

An advertisement calling for applications from persons desirous of engaging in the cultivation of flax having been inserted in the public papers, and replies thereto, accompanied in each instance by a description of the soil and situation, having been received, it is intended—

1. To supply seed gratuitously to such applicants as may be selected by the department, but in such quantity only as may be considered expedient by the Minister of Agriculture.

2. To furnish with the seed in each instance detailed information regarding the most approved systems of cultivation and preparation of the fibre for market.

3. With a view of establishing the industry, the department intends to grant bonuses to those farmers or cultivators who produce the most marketable samples of fibre ; quantity to be taken into consideration ; such awards to be made subject to the following conditions :—

(1.) Recipients of seed will be required to forward to the department 25 lbs. weight of fibre prepared for market, such being a representative sample of the total produce, and to be grown from the seed supplied.

(2.) The above-mentioned samples will be duly catalogued, and submitted to judges for classification, after which they will be offered for sale, and the decision of the judges, taken in conjunction with the other circumstances, will regulate the amount of the bonuses and awards.

(3.) The sums realised by the above-mentioned sales will be handed over to the respective owners of the samples supplied.

(4.) The demand for flax in Victoria being limited to such samples as are used in the manufacture of rope, bagging, and twines, no preference will be given to persons dressing their fibre more highly than is necessary for such purposes.

Department of Lands and Agriculture,
4th August 1873.

Additional Regulation made by the Governor in Council in connexion with the sum of £900 voted by Parliament for the encouragement of the growth and production of Flax.

That whereas it is expedient for the economical production of flax to encourage, by the offering of money premiums, the invention and manufacture of machinery to supersede manual labor in the harvesting of the crop, it is recommended that the sum of £150 be set apart for such purpose out of the grant of £900 voted by Parliament for the encouragement of the growth and production of flax ; and it is likewise recommended that such sum be offered as premiums by the Department of Agriculture, and in conjunction with the Adelaide Chamber of Manufactures, and the Royal Agricultural Society of South Australia, on the following conditions, viz. :—

1. That a like sum be subscribed and offered jointly by the Adelaide Chamber of Manufactures and the Royal Agricultural Society of South Australia, and in conjunction with the Department of Agriculture of the Colony of Victoria.

2. That such joint premiums shall be open for competition both in South Australia and Victoria.

3. That an equal number of trials of the competing machines shall be held in either colony.

Department of Lands and Agriculture,
Melbourne, 23rd February 1874.

Grant to Agricultural Societies.

Regulations in connexion with the sum granted by Parliament in aid of the funds of Agricultural Societies 1873–4.

1. That the Societies furnish to the Minister of Agriculture, on or before the 1st February 1874, a statement showing the amount of the

revenue of each derived from private contributions of each between the 1st January 1873 and the 31st December 1873, together with a statement showing the sum paid away in prizes during the same period; both statements to be verified by a statutory declaration before a magistrate.

2. That on receipt of the above statement so verified, the Minister of Agriculture will cause to be paid to the proper officer of each society a sum equal to one-half of the amount shown to have been paid away in prizes by such society during the period before mentioned, on the condition that this sum is not in excess of the amount raised by private contributions. But if the proposed grant exceed the amount raised by private contributions, that it be in that case reduced to a sum equal to the amount so raised.

3. That of the total grant (£4500) a sum not exceeding Four thousand pounds shall be so divided; and if the sums claimable are in excess of this amount, they shall be reduced *pro rata.*

4. That Five hundred pounds be given to some society in the interior, as the Minister of Agriculture may decide, as a subsidy towards the holding of a national show of live stock, implements, and farm produce in connexion with such society, conditionally—

(1.) On a sum not less than the amount so given being contributed by such society towards the expenses of holding said national show.

(2.) That the prizes to be offered at such national show shall be approved of by the Minister of Agriculture.

Department of Lands and Agriculture,
14th August 1873.

Grant to Horticultural Societies.

Regulations made by the Governor in Council for distribution of the sum granted by Parliament in aid of the funds of Horticultural Societies 1873–4.

1. That the Societies furnish to the Minister of Agriculture, on or before the 15th January 1874, a statement showing the amount of the revenue of each derived from private contributions between the 1st January 1873 and the 31st December 1873, such statement to be verified by statutory declaration before a magistrate.

2. That on receipt of the above statement so verified, the Minister of Agriculture will cause to be paid to the proper officer of each society a sum equal to the amount of the revenue shown to have been so raised during the period before-mentioned, provided that the whole sum divided do not exceed Five hundred pounds, and if the sums claimable are in excess of this amount, that they be reduced *pro rata.*

Department of Lands and Agriculture,
25th September 1873.

Beet-root Sugar.

Regulations made by the Governor in Council for distribution of the sum granted by Parliament for the encouragement of the manufacture of Beet-root Sugar.

The amount, Five thousand pounds, granted by the Legislature for the encouragement of the manufacture of Beet-root Sugar, will be available for distribution as follows, viz. :—

1. To any person or company who may produce, on or before 30th June 1874, satisfactory evidence to the Government that he or they have manufactured (locally from one manufactory, within twelve months) a quantity of not less than Five hundred tons of sugar from beet-root grown within the Colony of Victoria, the sum of Five thousand pounds; or, in the event of no claim being substantiated as above—

2. To any person or company producing proof to the satisfaction of the Government that he or they respectively have manufactured (locally from one manufactory, and within a period of twelve months), on or before 30th June 1874, a quantity of not less than One hundred tons of sugar from beet-root grown within the Colony of Victoria, a proportionate amount of the said sum of Five thousand pounds.

Department of Lands and Agriculture,
25th September 1873.

Schedule of Distribution of Grant to Agricultural Societies.

Name of Society.	Total Amount Claimed.	Amounts Claimed on Moneys paid away prior to 1st January 1873. †	Amounts Claimed on Moneys paid away during 1873. ‡	Claims on Moneys paid away in 1873 reduced *pro rata*.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Apsley	34 5 0	...	34 5 0	29 13 4
Ararat	129 7 6	...	129 7 6	112 1 5
Australia Felix ...	60 15 0	...	60 15 0	52 12 5
Bacchus Marsh ...	*71 0 0	3 0 0	68 0 0	58 18 2
Ballarat	*849 4 0	324 17 6	524 6 6	454 4 4
Baringhup	78 4 0	...	78 4 0	67 14 8
Beaufort	86 1 3	...	86 1 3	74 11 0
Belfast	74 15 3	...	74 15 3	64 15 4
Bendigo	*517 13 9	264 2 6	253 11 3	219 13 2
Chiltern	31 17 6	...	31 17 6	27 12 0
Dandenong	45 15 0	...	45 15 0	39 12 7
Eddington	68 14 9	...	68 14 9	59 10 10
Geelong	504 9 6	...	504 9 6	437 0 5
Gippsland North ...	*118 10 0	12 10 0	106 0 0	91 16 6
Glendaruel	*244 13 6	131 10 3	113 3 3	98 0 7
Glenlyon	110 17 6	...	110 17 6	96 1 0
Hamilton	175 5 0	...	175 5 0	151 16 0
Hampden	57 13 0	...	57 13 0	49 18 9
Hardie's Hill	8 5 0	...	8 5 0	7 7 3
Hexham	55 5 0	...	55 5 0	47 17 2
Kyneton	*592 8 9	166 10 0	425 18 9	368 19 8
Mansfield	54 18 6	...	54 18 6	47 11 6
Maryborough	48 7 9	...	48 7 9	41 18 3
Mornington	53 0 0	...	53 0 0	45 18 2
Newbridge	36 12 6	...	36 12 6	31 14 5
Newstead	*77 14 9	25 15 0	51 19 9	45 0 7
North Western ...	25 12 6	...	25 12 6	22 3 11
Ovens and Murray ...	203 12 9	...	203 12 9	176 8 2
Polwarth, &c.	58 17 9	...	58 17 9	51 0 0
Smeaton	*643 15 10	307 4 6	336 11 4	291 11 2
St. Arnaud	81 10 0	...	81 10 0	70 12 0
Talbot	79 5 0	...	79 5 0	68 13 0
Victoria	118 15 6	...	118 15 6	102 17 8
Villiers and Heytesbury...	143 15 0	...	143 15 0	124 10 6
Wahgunyah	43 17 6	...	43 17 6	38 0 1
Western District ...	*341 2 6	168 2 6	173 0 0	149 17 2
Wimmera	95 1 3	...	95 1 3	82 6 10
	6,020 19 4	1,403 12 3	4,617 7 1	4,000 0 0

* This claim extends over a period exceeding one year.

† The sums in this column have been provided on a Supplementary Estimate.

‡ The sums claimed have been reduced *pro rata*, in accordance with Clause 3 of the Regulations.

Schedule of Distribution of Vote in Aid of the Funds of the Horticultural Societies of Victoria, in accordance with the Regulations approved by the Governor in Council.

	£	s.	d.
Ballarat Horticultural Society	89	15	10
Brighton Horticultural Society	92	10	10
Horticultural Improvement Society... ...	98	10	4
Victoria Horticultural Society	219	3	0
	£500	0	0

Schedule of Awards recommended by the Judges appointed to examine and report on the Samples of Flax submitted for competition, in accordance with the Regulations for the "Encouragement of the Growth and Production of Flax."

—	Name.	Address.	Bonus awarded.
1	D. Cathcart	Hesket	£50
2	D. McAndrew ...	Queenscliff	£50
3	T. Longmire	Hit-or-miss	£30
4	C. Bailey	Greenvale, Broadmeadows ...	Nil
5	J. Dowey	Romsey	Nil
6	T. Skelton	Mount Clear, Ballarat ...	Nil

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